

General Description

The UV4009DE combines advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge.

This device is suitable for use in PWM, load switching and general purpose applications.

Features

Enhancement Mode

Very low on-resistance $R_{DS(on)}$

100% Avalanche Tested

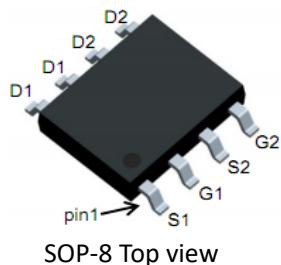
	N-ch	P-ch	
VDS	40	-40	V
$R_{DS(on)} \text{ TYP}$	16	37	$\text{m}\Omega$
I_D	8.5	-8	A

Applications

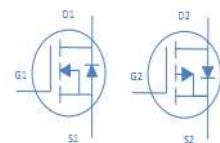
Power switching application

Hard Switched and High Frequency Circuits

BLDC Motor driver



SOP-8 Top view



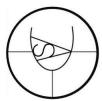
Schematic diagram

Package Marking And Ordering Information

Part ID	Package Type	Marking	Tape and Reel information
UV4009DE	SOP8	UV4009DE	3000pcs/REEL

Maximum ratings, at $T_j=25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Rating		Unit
		N-ch	P-ch	
$V_{(\text{BR})DSS}$	Drain –Source breakdown voltage	40	-40	V
I_D	Continuous drain current @ $V_{gs}=10\text{V}$	$T_c=25^\circ\text{C}$	8.5	A
		$T_c=100^\circ\text{C}$	7	A
I_{DM}	Pulse drain current tested①	$T_c=25^\circ\text{C}$	30	A
E_{AS}	Avalanche energy, single pulsed②	17	24	mJ
I_{AS}	Avalanche Current	26	-22	A
P_D	Maximum power dissipation	$T_c=25^\circ\text{C}$	4	W
V_{GS}	Gate-Source voltage	± 20	± 20	V
$T_{STG} T_j$	Storage and operating temperature range	-55 to 175		°C



Thermal Characteristic

Symbol	Parameter	Typical	Unit
R_{QJC}	Thermal Resistance-Junction to Case	1.3	°C/W
R_{QJA}	Thermal Resistance-Junction to Ambient	36	°C/W

N-Channel Electrical Characteristics($T_j=25^\circ\text{C}$,unless otherwise noted)

Symbol	Parameter	Condition	Min	Type	Max	Unit
Static Electrical Characteristics @ $T_j=25^\circ\text{C}$ (unless otherwise stated)						
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$	40			V
$V_{(\text{BR})\text{DSS}}/T_j$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$		0.034		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=32\text{V}$, $V_{GS}=0\text{V}$			1	μA
	Zero Gate Voltage Drain Current($T_j=55^\circ\text{C}$)	$V_{DS}=32\text{V}$, $V_{GS}=0\text{V}$			5	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$			± 100	nA
$V_{GS(\text{TH})}$	Gate Threshold Voltage	$V_{DS}=VGS$, $I_D=250\mu\text{A}$	1	1.4	2.5	V
$R_{DS(\text{ON})}$	Drain-Source On-State Resistance③	$V_{GS}=10\text{V}$, $I_D=5\text{A}$		16	22	mΩ
		$V_{GS}=4.5\text{V}$, $I_D=4\text{A}$		33	40	mΩ
g_{fs}	Forward Trans conductance	$V_{DS}=5\text{V}$, $I_D=7.5\text{A}$		20		s
R_g	Gate Resistance	$V_{DS}=0\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{mHz}$		2.6		Ω
Dynamic Electrical Characteristics @ $T_j=25^\circ\text{C}$ (unless otherwise stated)						
C_{iss}	Input Capacitance	$V_{DS}=20\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{MHz}$		536		PF
C_{oss}	Output Capacitance			83		PF
C_{rss}	Reverse Transfer Capacitance			66		PF
Q_g	Total Gate Charge(10V)	$V_{DS}=20\text{V}$, $I_D=7.5\text{A}$, $V_{GS}=10\text{V}$		14.5		nC
Q_{gs}	Gate-Source Charge			2.1		nC
Q_{gd}	Gate-Drain Charge			4.3		nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay time	$V_{DD}=10\text{V}$, $I_D=1\text{A}$, $R_G=6\Omega$, $V_{GS}=10\text{V}$		5		nS
t_r	Turn-on Rise time			10		nS
$t_{d(off)}$	Turn-off Delay time			15		nS
t_f	Turn-off Fall time			12		nS
Source-Drain Diode Characteristics						
V_{SD}	Forward on voltage	$I_{SD}=1\text{A}$, $V_{GS}=0\text{V}$			1.2	V
I_s	Continuous Source Current	Force Current			8	A
I_{sm}	Pulsed Source Current				30	A

Note:

- ① Repetitive rating; pulse width limited by max, junction temperature.
- ② Limited by $T_{j\max}$, starting $T_j=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_G=25\Omega$, $I_{AS}=9\text{A}$, $V_{GS}=10\text{V}$, Part not recommended for use above this value
- ③ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$

**P-Channel Electrical Characteristics($T_j=25^\circ\text{C}$,unless otherwise noted)**

Symbol	Parameter	Condition	Min	Type	Max	Unit
Static Electrical Characteristics @ $T_j=25^\circ\text{C}$ (unless otherwise stated)						
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$ $I_D=250\mu\text{A}$	-40			V
$V_{(\text{BR})\text{DSS}/T_j}$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1\text{mA}$		-0.015		$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-32\text{V}$, $V_{GS}=0\text{V}$			1	μA
	Zero Gate Voltage Drain Current($T_j=55^\circ\text{C}$)	$V_{DS}=-32\text{V}$, $V_{GS}=0\text{V}$			5	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm20\text{V}$, $V_{DS}=0\text{V}$			±100	nA
$V_{GS(\text{TH})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	-1	-1.4	-2.5	V
$R_{DS(\text{ON})}$	Drain-Source On-State Resistance ^③	$V_{GS}=-10\text{V}$, $I_D=-4\text{A}$		37	42	$\text{m}\Omega$
		$V_{GS}=-4.5\text{V}$, $I_D=-3\text{A}$		70	85	$\text{m}\Omega$
g_{fs}	Forward Trans conductance	$V_{DS}=-10\text{V}$, $I_D=-6\text{A}$		10		s
R_g	Gate Resistance	$V_{DS}=0\text{V}$, $V_{GS}=0\text{V}$, $F=1\text{mHz}$		2.6		Ω
Dynamic Electrical Characteristics @ $T_j=25^\circ\text{C}$ (unless otherwise stated)						
C_{iss}	Input Capacitance	$V_{DS}=-20\text{V}$, $V_{GS}=0\text{V}$, $F=1\text{MHz}$		810		PF
C_{oss}	Output Capacitance			94		PF
C_{rss}	Reverse Transfer Capacitance			72		PF
Q_g	Total Gate Charge(-10V)	$V_{DS}=-20\text{V}$, $I_D=-6\text{A}$, $V_{GS}=-10\text{V}$		15		nC
Q_{gs}	Gate-Source Charge			2.6		nC
Q_{gd}	Gate-Drain Charge			3.1		nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay time	$V_{DD}=-12\text{V}$ $I_D=-1\text{A}$ $R_G=6\Omega$ $V_{GS}=-10\text{V}$		12		nS
t_r	Turn-on Rise time			15		nS
$t_{d(off)}$	Turn-off Delay time			25		nS
t_f	Turn-off Fall time			15		nS
Source-Drain Diode Characteristics						
V_{SD}	Forward on voltage	$I_{SD}=-1\text{A}$, $V_{GS}=0\text{V}$			-1.2	V
I_s	Continuous Source Current	$V_G=V_D=0\text{V}$ Force Current			-8	A
I_{sm}	Pulsed Source Current				-24	A

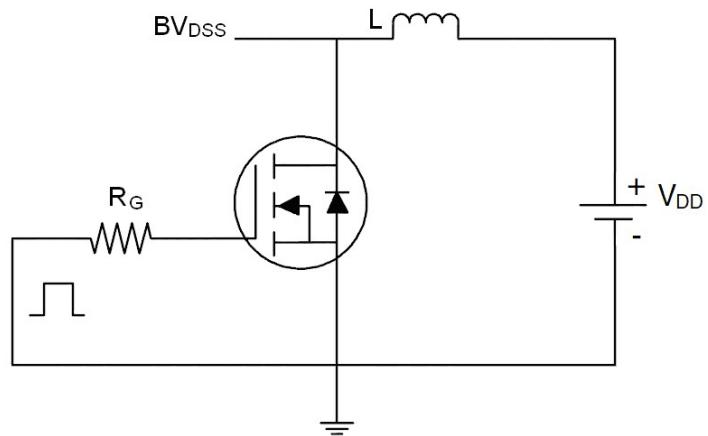
Note:

- ④ Repetitive rating; pulse width limited by max, junction temperature.
- ⑤ Limited by $T_{j\max}$, starting $T_j=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_G=25\Omega$, $I_{AS}=9\text{A}$, $V_{GS}=-10\text{V}$, Part not recommended for use above this value
- ⑥ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$

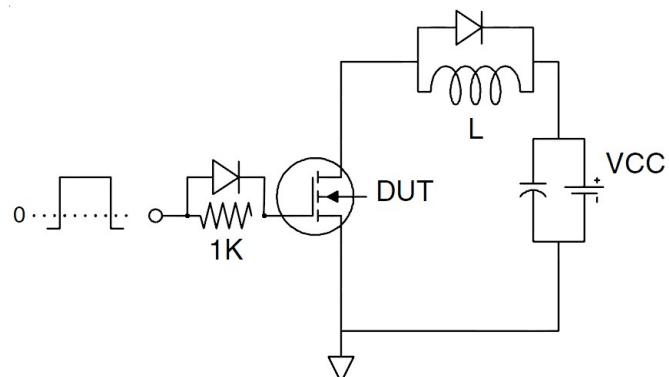


Test circuit

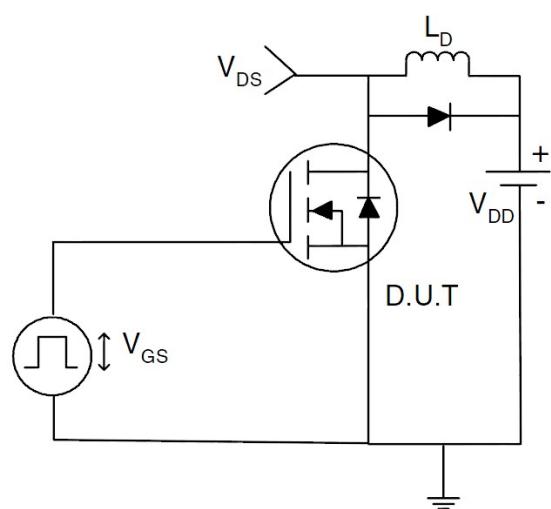
(1) E_{AS} test circuits

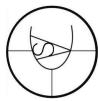


(2) Gate charge test circuit



(3) Switch time test circuit





N-Channel Typical Characteristics

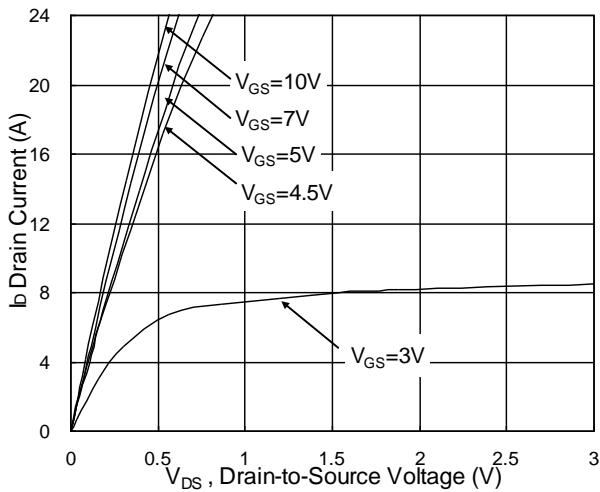


Fig.1 Typical Output Characteristics

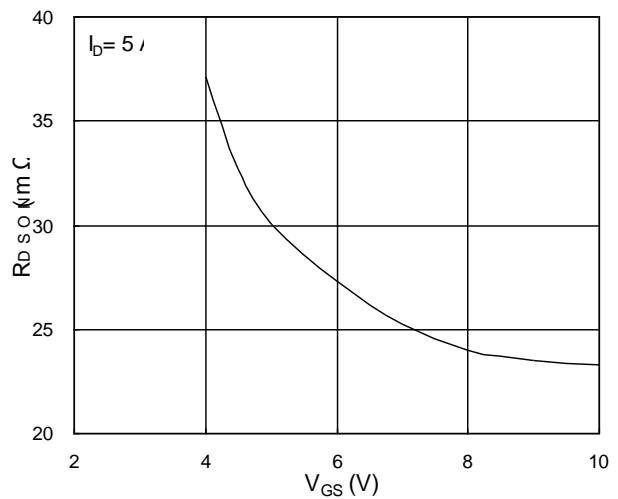


Fig.2 On-Resistance vs. G-S Voltage

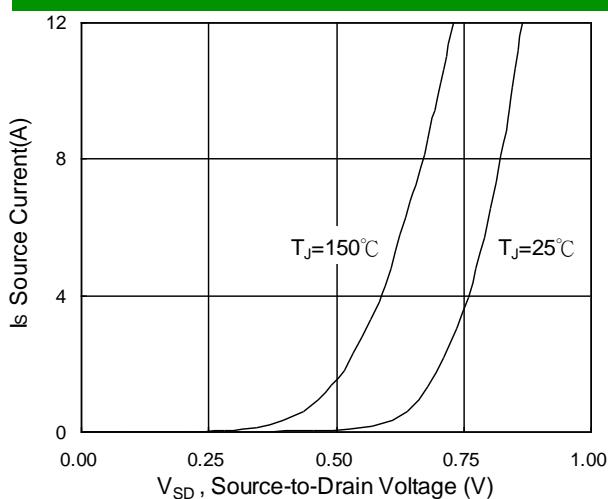


Fig.3 Forward Characteristics of Reverse

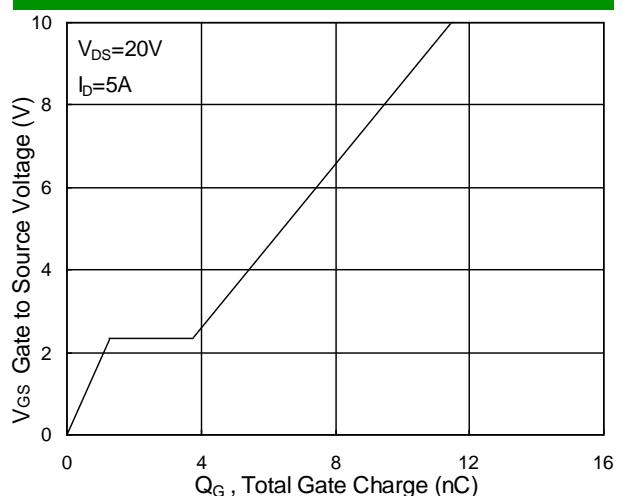


Fig.4 Gate-Charge Characteristics

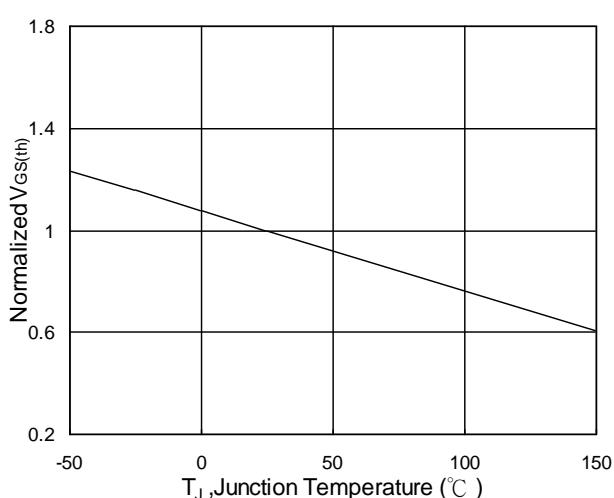


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

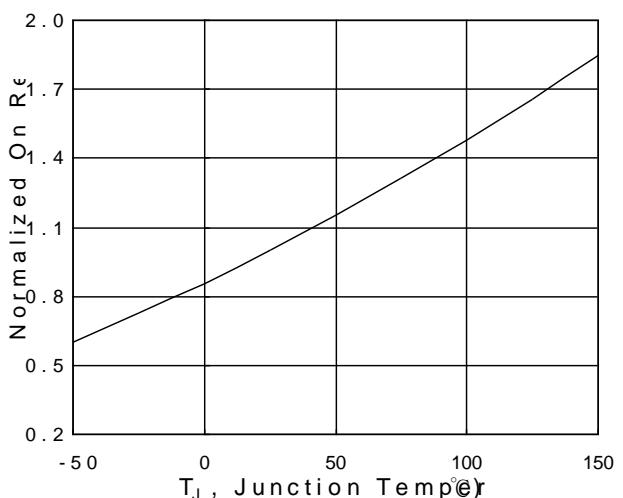
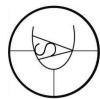


Fig.6 Normalized $R_{DS(on)}$ vs. T_J



UV4009DE
40V N+P-Channel Mosfet

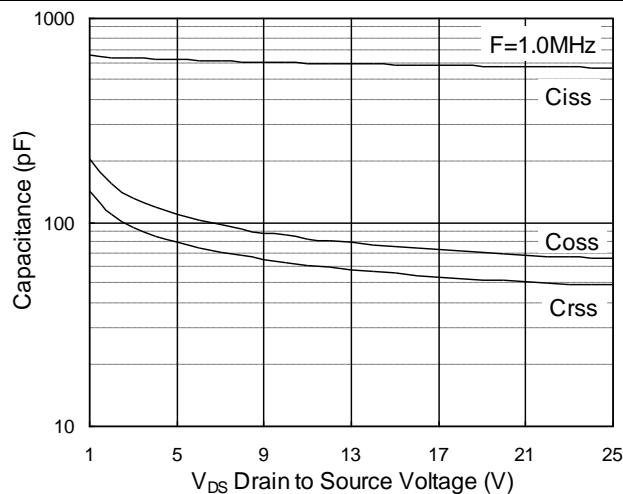


Fig.7 Capacitance

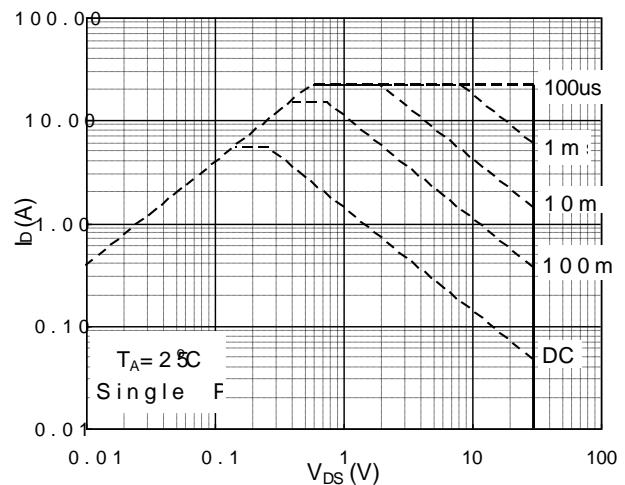
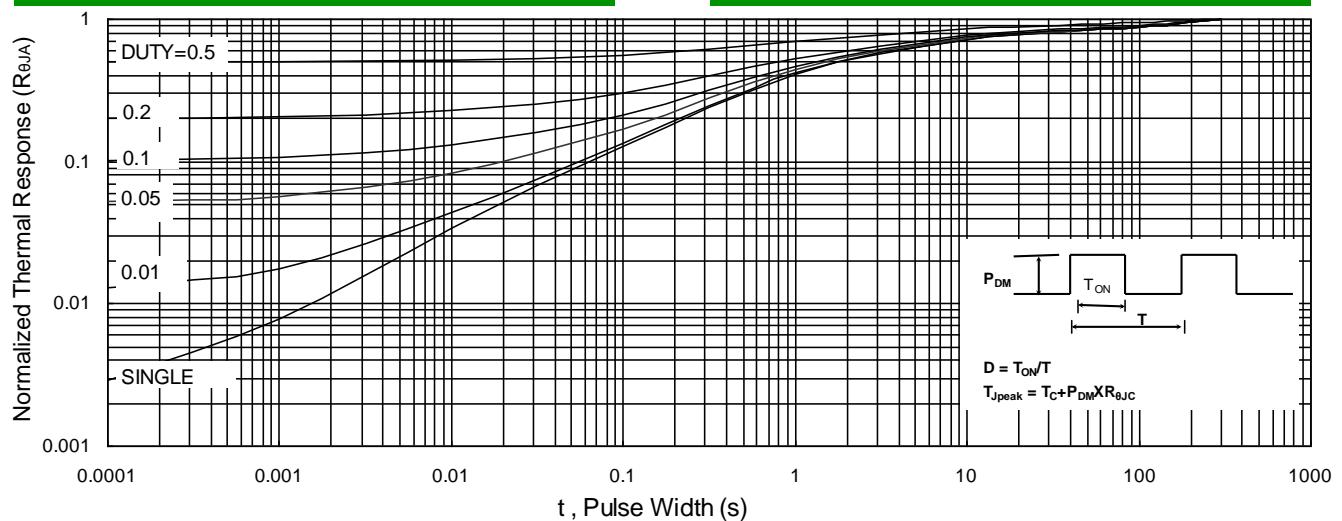
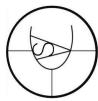


Fig.8 Safe Operating Area





P-Channel Typical Characteristics

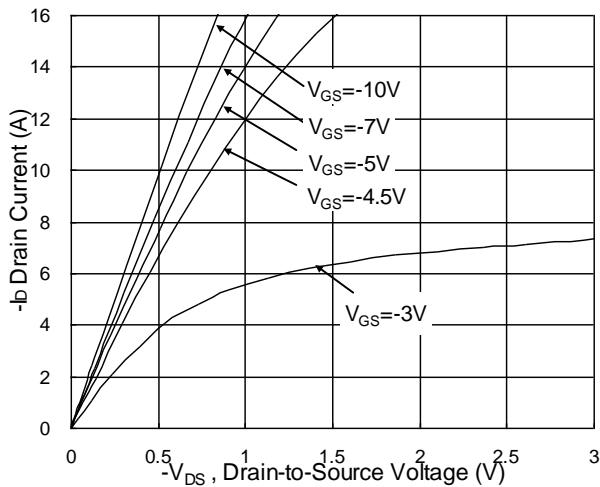


Fig.1 Typical Output Characteristics

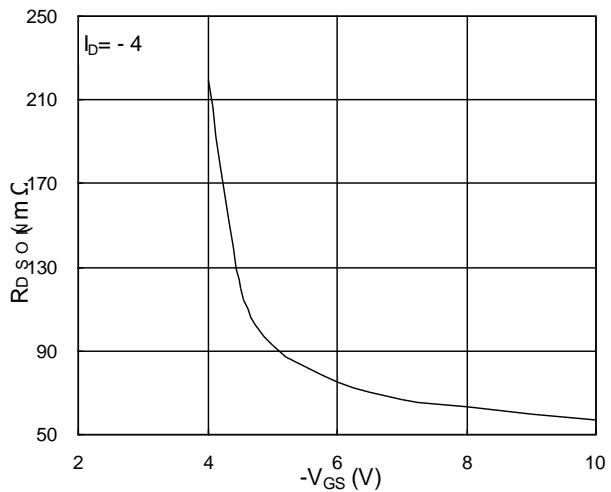


Fig.2 On-Resistance v.s Gate-Source

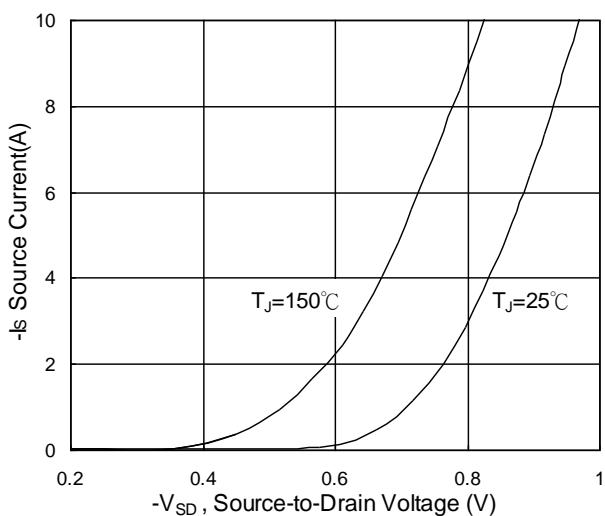


Fig.3 Forward Characteristics Of Reverse

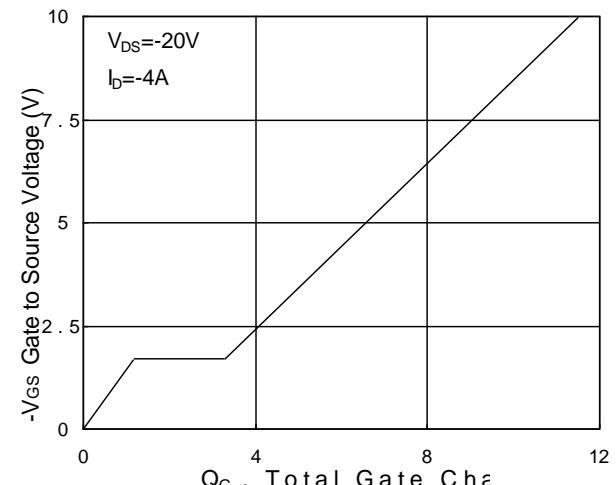


Fig.4 Gate Charge Characteristics

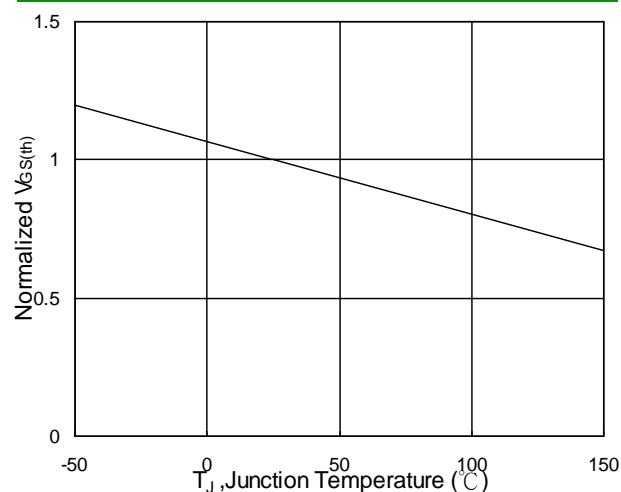


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

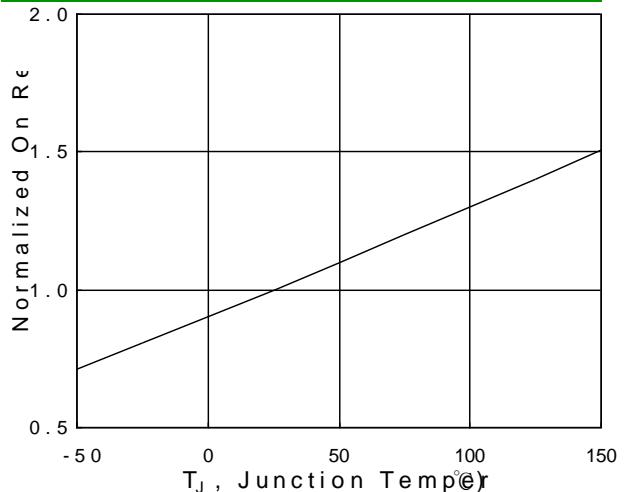
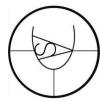


Fig.6 Normalized $R_{DS(on)}$ v.s T_J



UV4009DE
40V N+P-Channel Mosfet

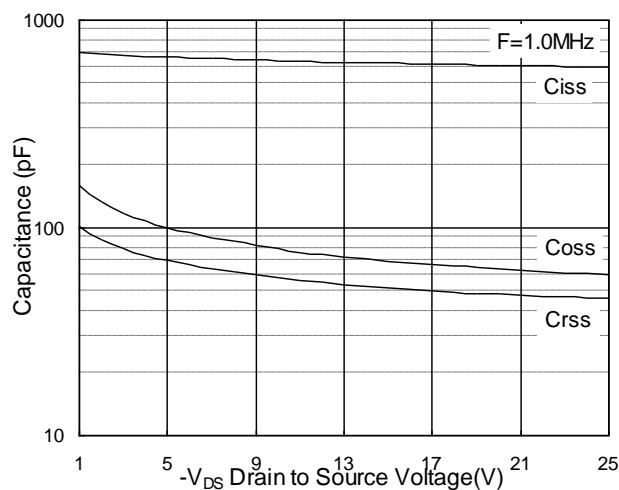


Fig.7 Capacitance

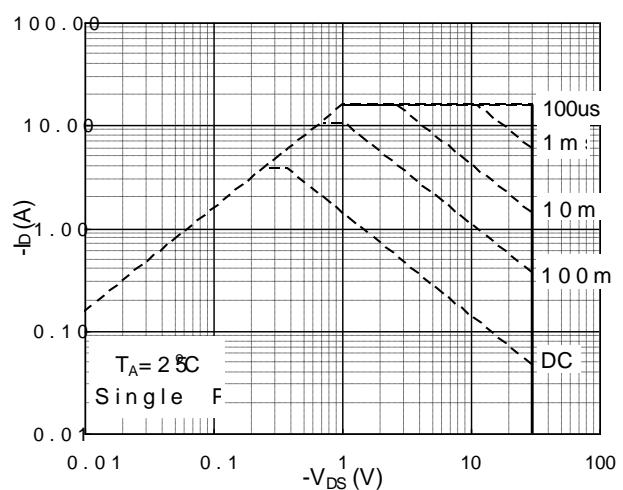
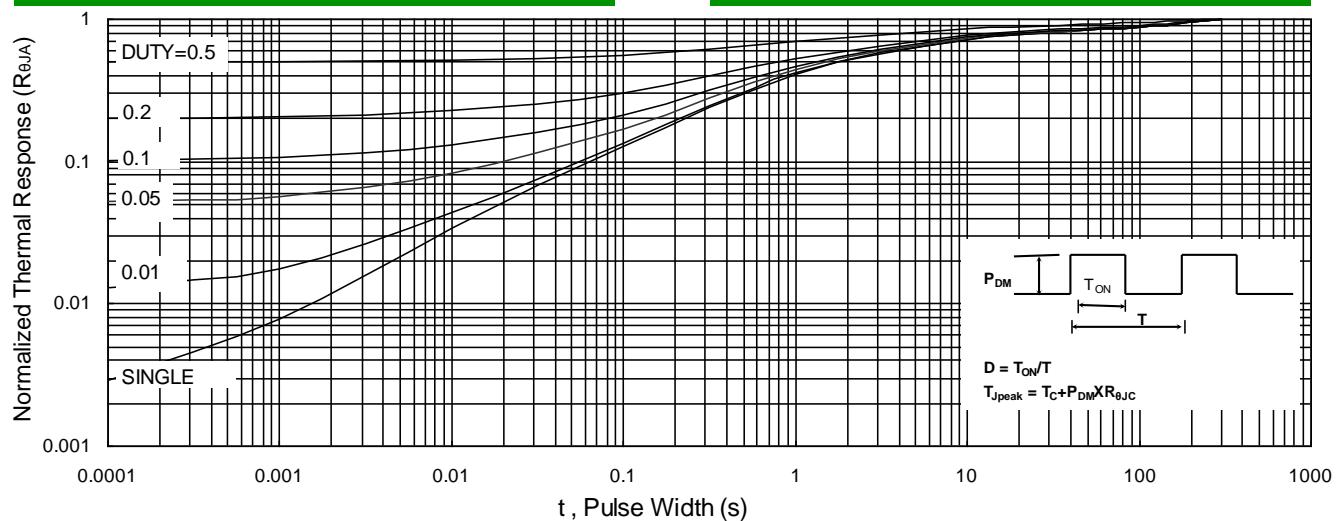


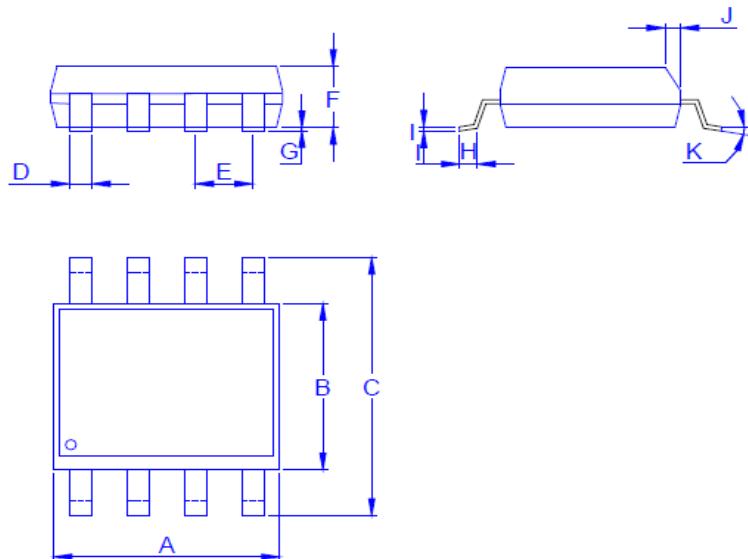
Fig.8 Safe Operating Area





Package Outline

SOIC-8, 8leads



Dimension in mm

Dimension	A	B	C	D	E	F	G	H	I	J	K
Min.	4.70	3.70	5.80	0.33		1.20	0.08	0.40	0.19	0.25	0°
Typ.					1.27						
Max.	5.10	4.10	6.20	0.51		1.62	0.28	0.83	0.26	0.50	8°