

TM024G04S

N+P-Channel Enhancement Mode Mosfet

General Description

- Low $R_{DS(ON)}$
- RoHS and Halogen-Free Compliant

Applications

- Load switch
- PWM

Product Summary

N Channel

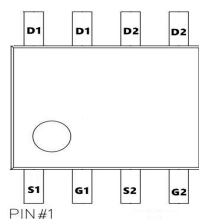
$V_{DS} = 40V$, $I_D = 8A$
 $R_{DS(ON)} = 24m\Omega$ (typ.) @ $V_{GS} = 10V$

P Channel

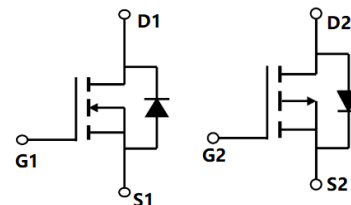
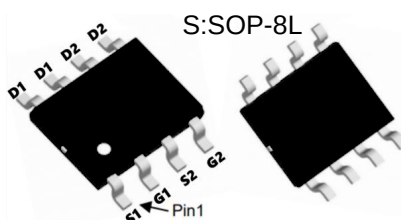
$V_{DS} = -40V$, $I_D = -7A$
 $R_{DS(ON)} = 35m\Omega$ (typ.) @ $V_{GS} = -10V$

100% UIS Tested

100% R_g Tested



Marking: 08G04 OR 4614B



Absolute Maximum Ratings ($T_c = 25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
V_{DS}	Drain-Source Voltage	40	-40	V
V_{GS}	Gate-Source Voltage	± 20	± 20	V
$I_D @ T_A = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	8	-7	A
$I_D @ T_A = 70^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	4.2	-4.2	A
I_{DM}	Pulsed Drain Current ²	26	-24	A
EAS	Single Pulse Avalanche Energy ³	16.2	39	mJ
$P_D @ T_A = 25^\circ C$	Total Power Dissipation ⁴	1.67	1.67	W
T_{STG}	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	57		$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	30		$^\circ C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	44	---	V
$\Delta BVDSS/\Delta T_J$	BVDSS Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	0.034	---	V/ $^\circ\text{C}$
RDS(ON)	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=5A$	---	24	35	m Ω
		$V_{GS}=4.5V, I_D=4A$	---	36	49	
VGS(th)	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.5	2.5	3.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.56	---	mV/ $^\circ\text{C}$
IDSS	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
IGSS	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
gfs	Forward Transconductance	$V_{DS}=5V, I_D=5A$	---	14	---	S
Rg	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1MHz$	---	2.6	---	Ω
Qg	Total Gate Charge (4.5V)	$V_{DS}=20V, V_{GS}=4.5V, I_D=5A$	---	5.5	---	nC
Qgs	Gate-Source Charge		---	1.25	---	
Qgd	Gate-Drain Charge		---	2.5	---	
Td(on)	Turn-On Delay Time	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=1A$	---	8.9	---	ns
Tr	Rise Time		---	2.2	---	
Td(off)	Turn-Off Delay Time		---	41	---	
Tf	Fall Time		---	2.7	---	
Ciss	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	593	---	pF
Coss	Output Capacitance		---	76	---	
Crss	Reverse Transfer Capacitance		---	56	---	
Is	Continuous Source Current ^{1,5}	$V_G=V_D=0V, \text{Force Current}$	---	---	6.1	A
ISM	Pulsed Source Current ^{2,5}		---	---	23	A
VSD	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V

Note :

- 1、The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2、The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3、The EAS data shows Max. rating . The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=10A$
- 4、The power dissipation is limited by 150°C junction temperature
- 5、The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=-250\mu A$	-40	---	---	V
$\Delta BVDSS/\Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=-1mA$	---	-0.02	---	V/ $^\circ\text{C}$
RDS(ON)	Static Drain-Source On-Resistance ²	$V_{GS}=-10V$, $I_D=-5A$	---	35	48	m Ω
		$V_{GS}=-4.5V$, $I_D=-3A$	---	49	68	
VGS(th)	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=-250\mu A$	-1.5	-2.5	-3.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	3.72	---	mV/ $^\circ\text{C}$
IDSS	Drain-Source Leakage Current	$V_{DS}=-32V$, $V_{GS}=0V$, $T_J=25^\circ\text{C}$	---	---	1	uA
		$V_{DS}=-32V$, $V_{GS}=0V$, $T_J=55^\circ\text{C}$	---	---	5	
IGSS	Gate-Source Leakage Current	$V_{GS}=\pm 20V$, $V_{DS}=0V$	---	---	± 100	nA
Qg	Total Gate Charge (-4.5V)	$V_{DS}=-20V$, $V_{GS}=-4.5V$, $I_D=-6A$	---	15.8	---	nC
Qgs	Gate-Source Charge		---	3.5	---	
Qgd	Gate-Drain Charge		---	3.2	---	
Td(on)	Turn-On Delay Time	$V_{DD}=-15V$, $V_{GS}=-10V$, $R_G=3.3\Omega$, $I_D=-1A$	---	5.2	---	ns
Tr	Rise Time		---	7	---	
Td(off)	Turn-Off Delay Time		---	23	---	
Tf	Fall Time		---	8	---	
Ciss	Input Capacitance	$V_{DS}=-15V$, $V_{GS}=0V$, $f=1MHz$	---	1000	---	pF
Coss	Output Capacitance		---	160	---	
Crss	Reverse Transfer Capacitance		---	100	---	
Is	Continuous Source Current ^{1,5}	$V_G=V_D=0V$, Force Current	---	---	-5.7	A
VSD	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=-1A$, $T_J=25^\circ\text{C}$	---	---	-1.2	V

Note :

- 1、The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
- 2、The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3、The EAS data shows Max. rating . The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-7A$
- 4、The power dissipation is limited by 150°C junction temperature
- 5、The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

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N-Channel Typical Characteristics

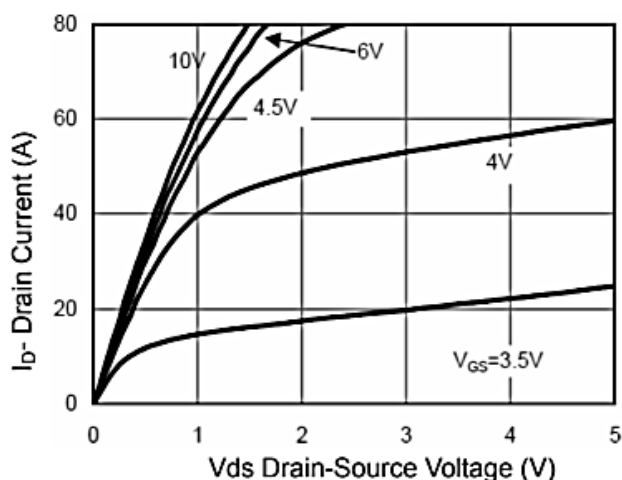


Figure 1 Output Characteristics

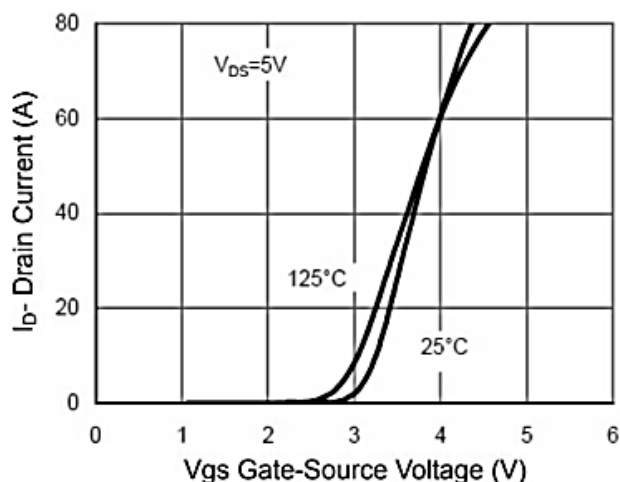


Figure 2 Transfer Characteristics

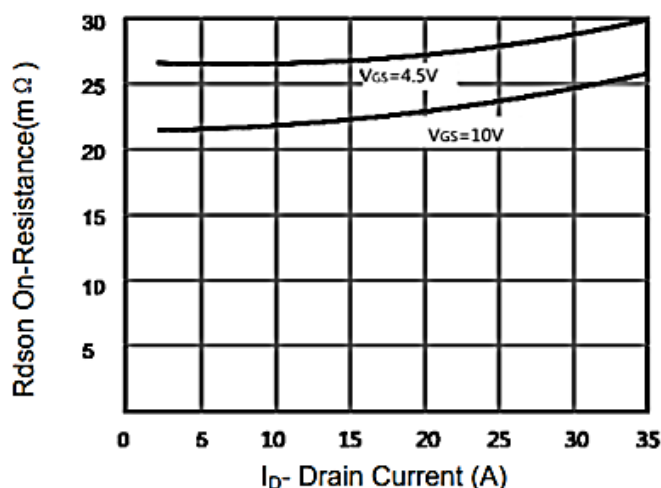


Figure 3 Rdson- Drain Current

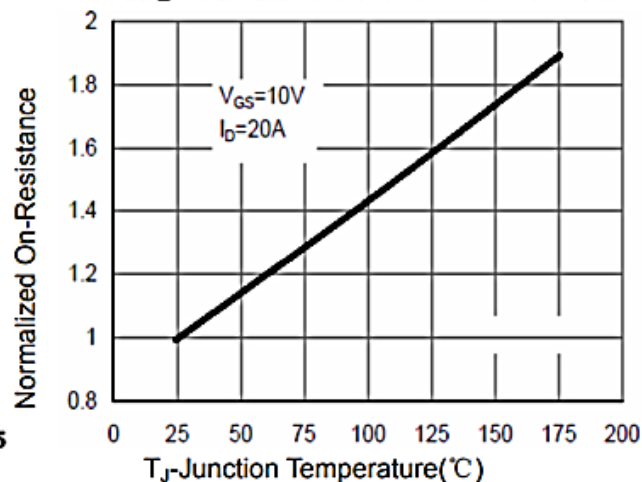


Figure 4 Rdson-Junction Temperature

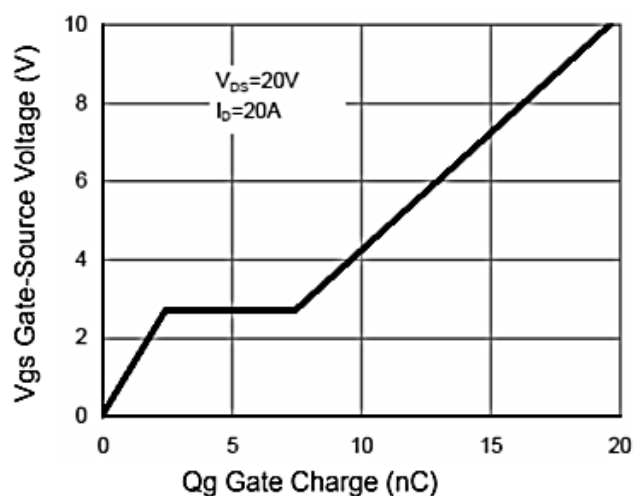


Figure 5 Gate Charge

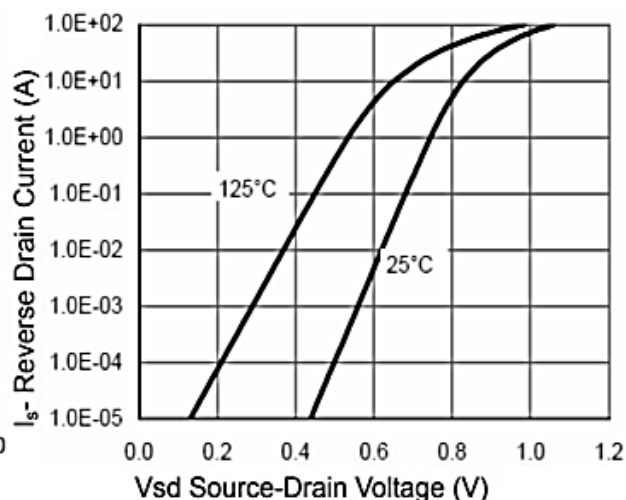


Figure 6 Source- Drain Diode Forward

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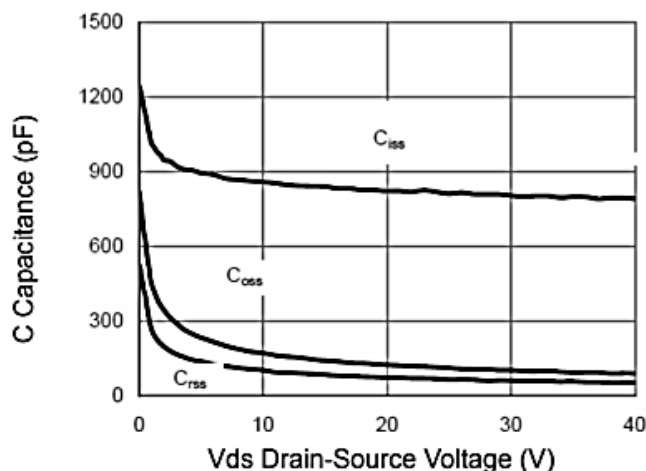


Figure 7 Capacitance vs Vds

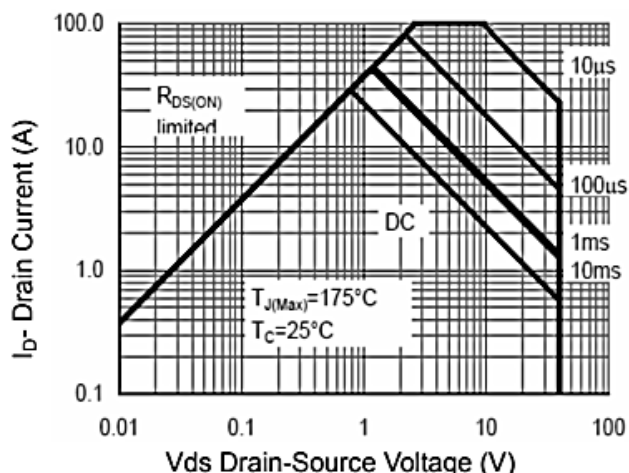


Figure 8 Safe Operation Area

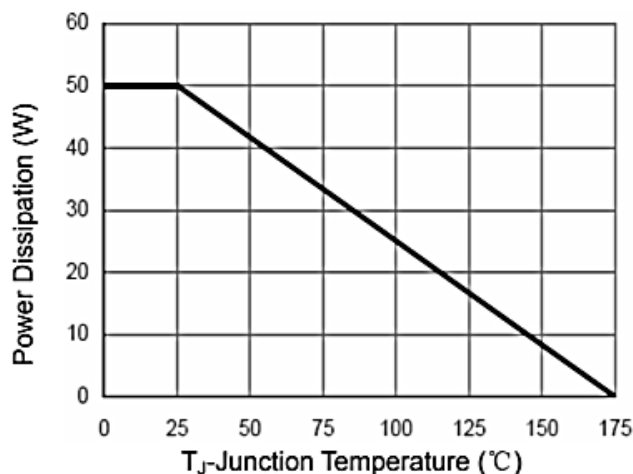


Figure 9 Power De-rating

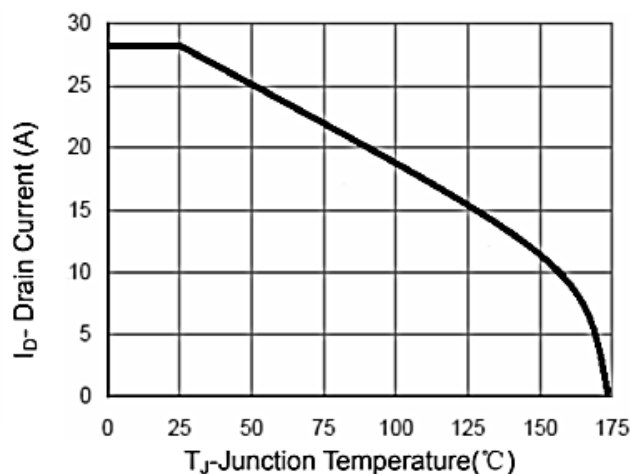


Figure 10 Id Current De-rating

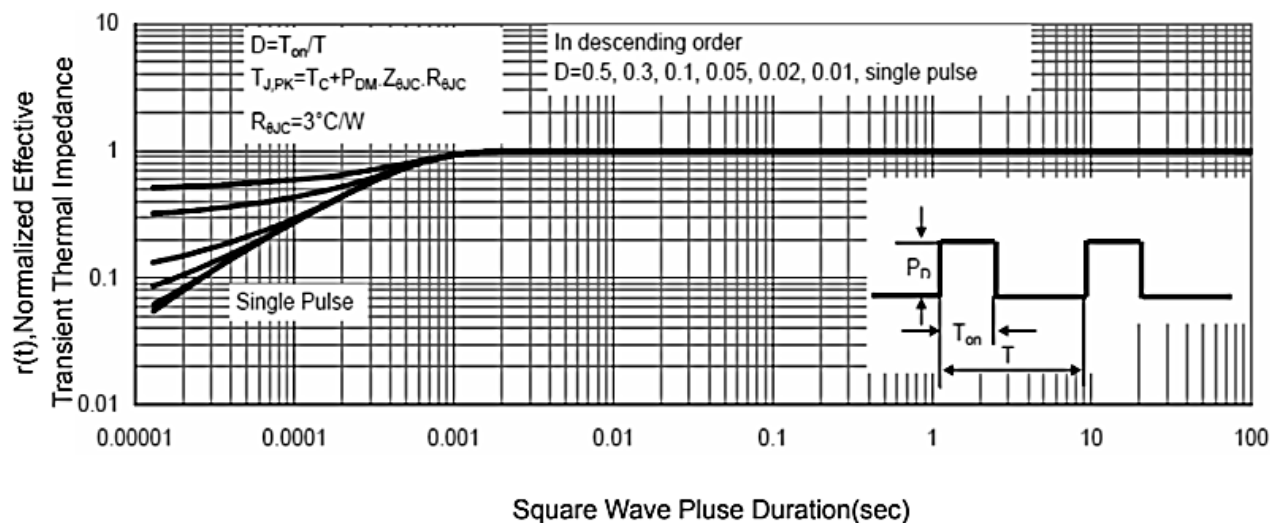


Figure 11 Normalized Maximum Transient Thermal Impedance

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P-Channel Typical Characteristics

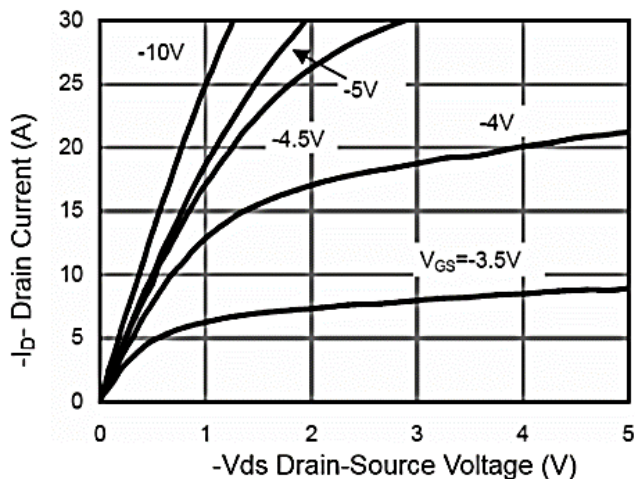


Figure 1 Output Characteristics

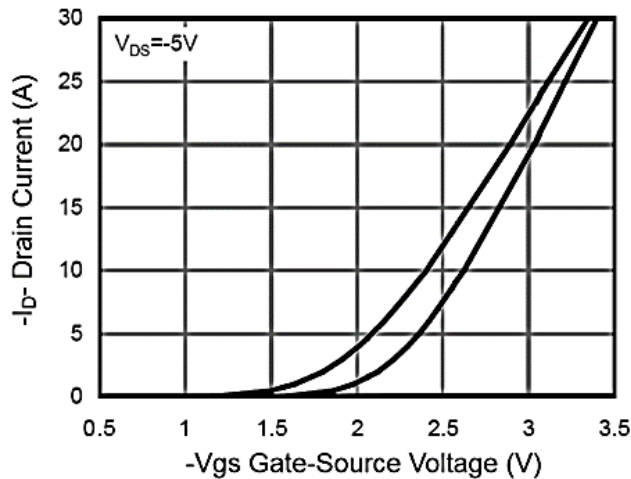


Figure 2 Transfer Characteristics

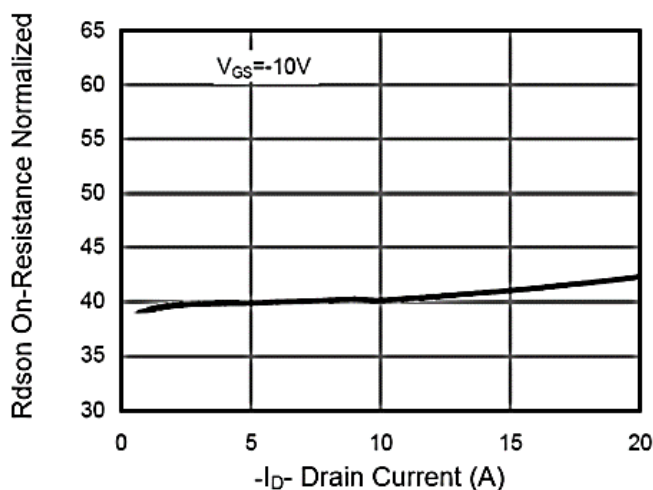


Figure 3 Rdson- Drain Current

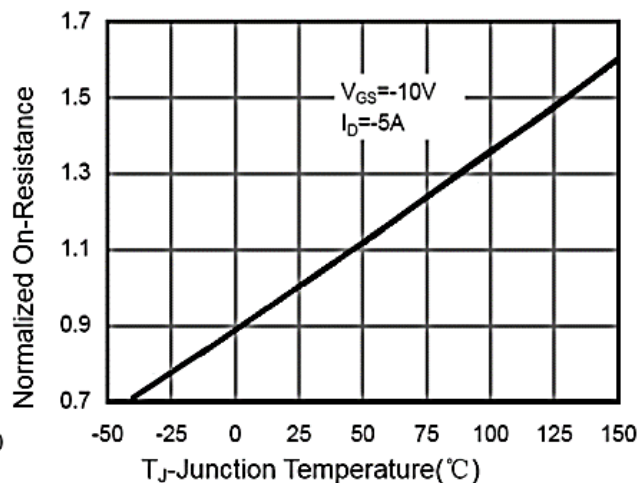


Figure 4 Rdson-Junction Temperature

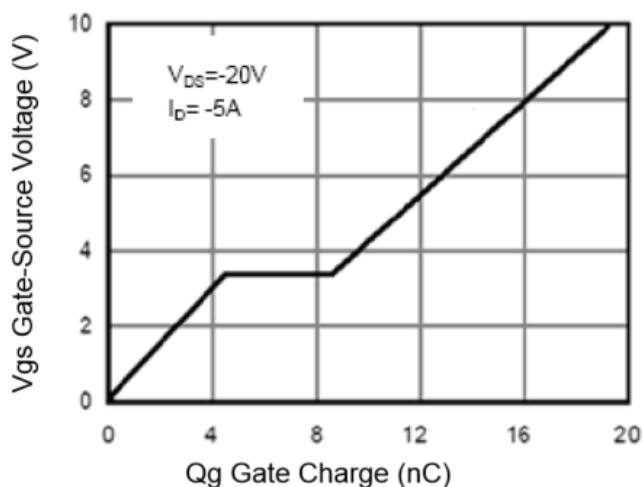


Figure 5 Gate Charge

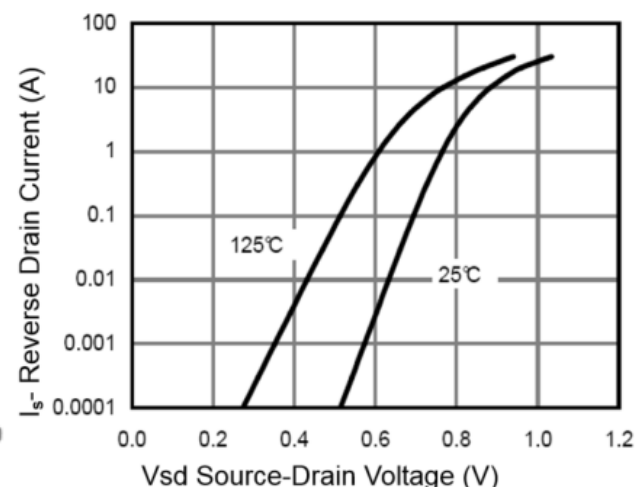


Figure 6 Source- Drain Diode Forward

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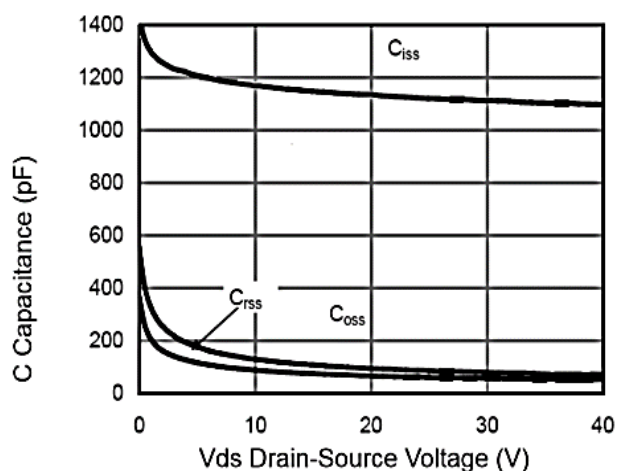


Figure 7 Capacitance vs Vds

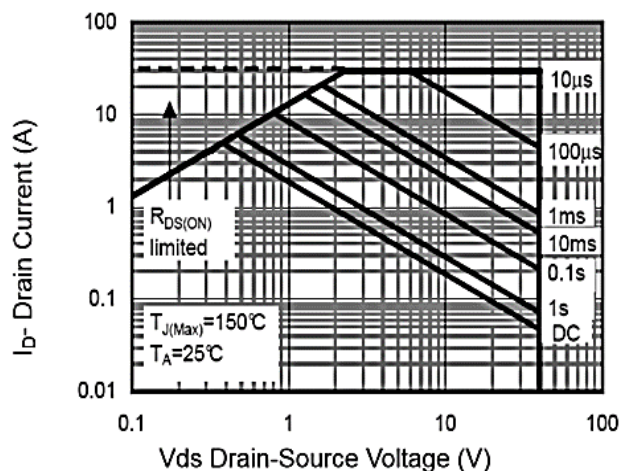


Figure 8 Safe Operation Area

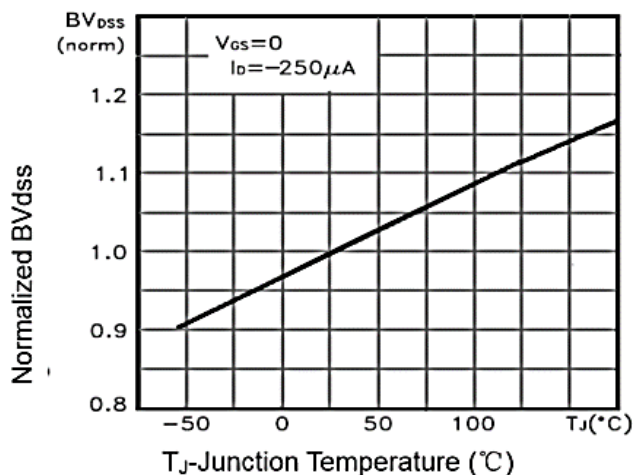


Figure 9 BV_{DSS} vs Junction Temperature

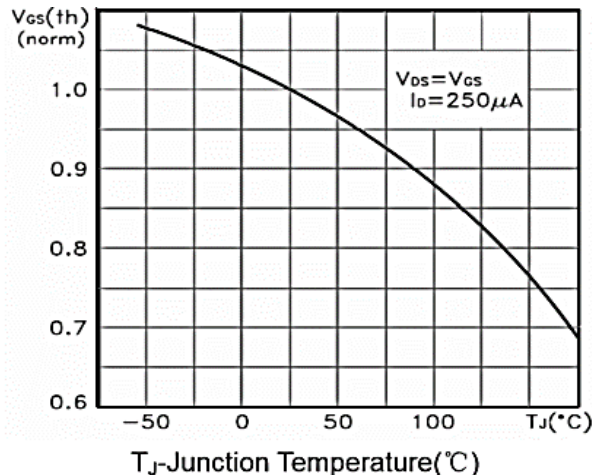


Figure 10 V_{GS(th)} vs Junction Temperature

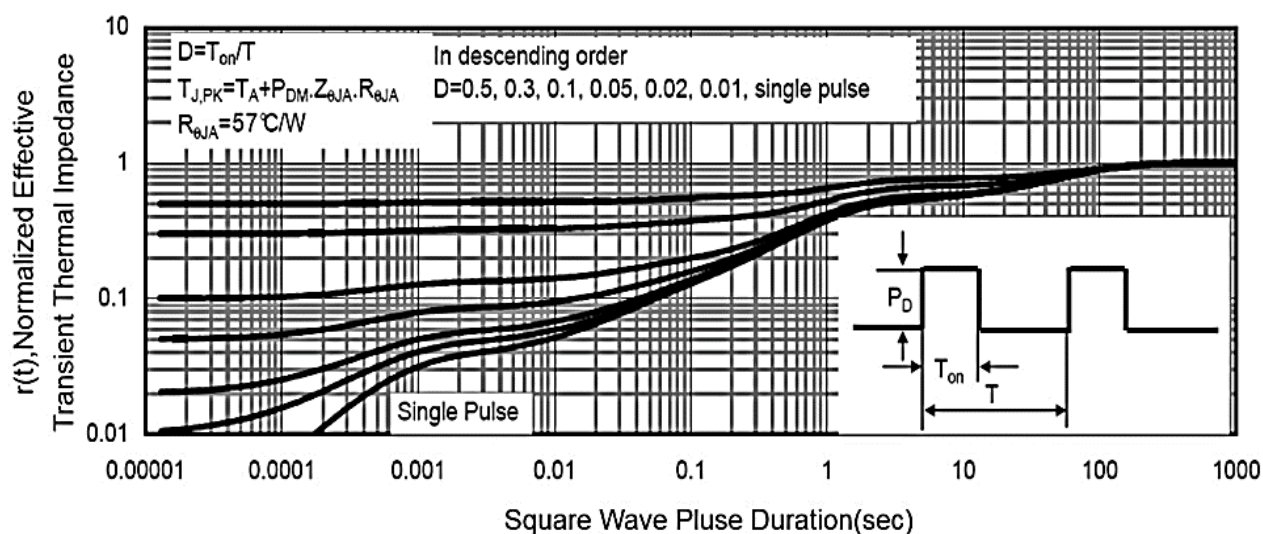
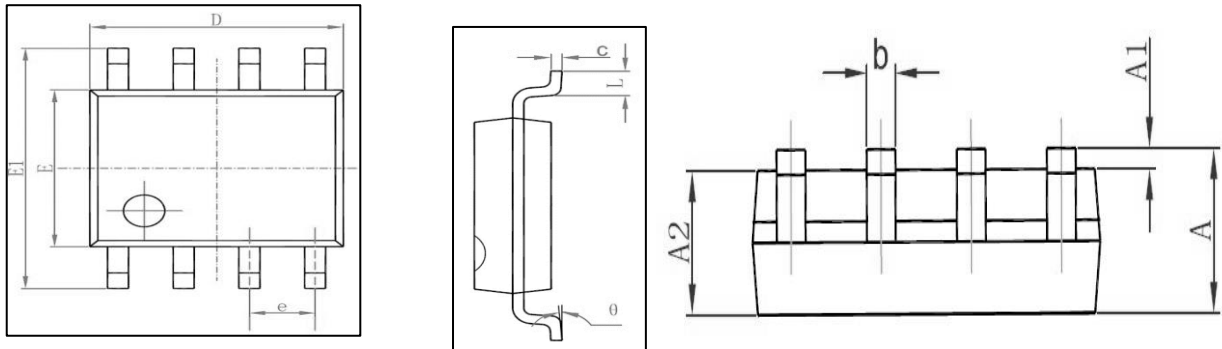
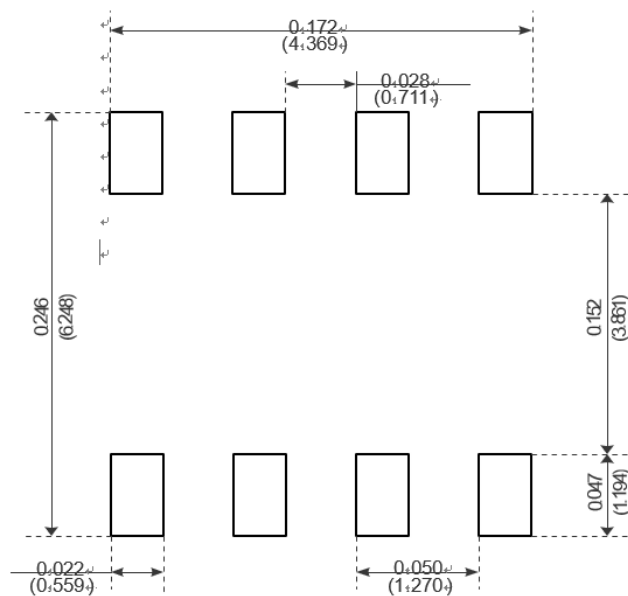


Figure 11 Normalized Maximum Transient Thermal Impedance

Package Mechanical Data:SOP-8L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Recommended Minimum Pads