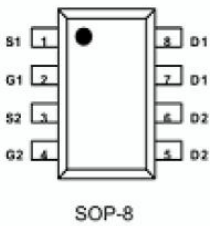





Features ➤ Super Low Gate Charge ➤ Green Device Available ➤ 100% EAS Guaranteed ➤ Excellent CdV/dt effect decline ➤ Advanced high cell density Trench technology	Bvdss	Rdson	ID
	40V	17mΩ	10A
	-40V	34mΩ	-10A
	Application ➤ Battery Switch ➤ Load switch ➤ Power management		



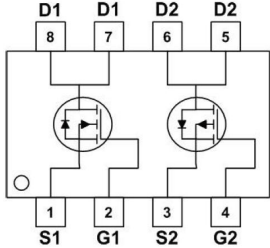
Package



1. Marking and pin assignment



2. SOP-8 top view



3. Schematic diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Quantity
10G04S	10G04S	SOP-8	3000

Absolute Maximum Ratings (T_c=25°C unless otherwise specified)

Parameter	Symbol	Max. N-Channel	Max. P-Channel	Unit
Drain-Source Voltage	V _{DS}	40	-40	V
Gate-Source Voltage	V _{GS}	±20	±20	V
Continuous Drain Current	I _D	10	-10	A
Continuous Drain Current	I _D	6.5	-6.5	A
Pulsed Drain Current(1)	I _{DM}	40	-40	A
Single Pulse Avalanche Energy(2)	EAS	19	27.5	mJ
Power Dissipation ²	P _d	3.4	7.5	W
Junction Temperature	T _J	-55~+150		°C
Storage Temperature	T _{STG}	-55~+150		°C



Ordering Information

Ordering Number	Package	Pin Assignment						Packing
Halogen Free		G1	G2	D1	D2	S1	S2	
HL10G04S	SOP-8	2	4	7,8	5,6	1	3	Tape Reel

N-Channel Electrical Characteristics (T_J=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =250μA	40	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =40V, V _{GS} =0V	-	-	1.0	μA
I _{GSS}	Gate to Body Leakage Current	V _{DS} =0V, V _{GS} =±20V	-	-	±100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.0	1.5	2.5	V
R _{DS(on)}	Static Drain-Source on-Resistance(3)	V _{GS} =10V, I _D =10A	-	17	20	mΩ
		V _{GS} =4.5V, I _D =5A	-	22	27	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} =20V, V _{GS} =0V, f=1.0MHz	-	980	-	pF
C _{oss}	Output Capacitance		-	86.2	-	pF
C _{rss}	Reverse Transfer Capacitance		-	68.5	-	pF
Q _g	Total Gate Charge	V _{DS} =20V, I _D =5A, V _{GS} =10V	-	11	-	nC
Q _{gs}	Gate-Source Charge		-	1.9	-	nC
Q _{gd}	Gate-Drain("Miller") Charge		-	2.2	-	nC
Switching Characteristics						
t _{d(on)}	Turn-on Delay Time	V _{DS} =20V, I _D = 5A, RL=2.5Ω, R _{REN} =3Ω	-	11	-	ns
t _r	Turn-on Rise Time		-	13	-	ns
t _{d(off)}	Turn-off Delay Time		-	36	-	ns
t _f	Turn-off Fall Time		-	9	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain to Source Diode Forward Current		-	-	10	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	40	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} =0V, I _S = 10A	-	-0.8	-1.2	V
t _{rr}	Body Diode Reverse Recovery Time	T _J =25°C, I _F =10A, dI/dt=100A/μs	-	19	-	ns
Q _{rr}	Body Diode Reverse Recovery		-	11	-	nC



Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition : $T_J=25^{\circ}\text{C}$, $V_{DD}=30\text{V}$, $V_G=10\text{V}$, $L=0.5\text{mH}$, $R_g=25\Omega$, $I_{AS}=8.7\text{A}$

$T_J=25^{\circ}\text{C}$, $V_{DD}=-30\text{V}$, $V_G=-10\text{V}$, $L=0.5\text{mH}$, $R_g=25\Omega$, $I_{AS}=-10.5\text{A}$

3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$ user's specific board design.

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$	-40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-40\text{V}$, $V_{GS}=0\text{V}$	-	-	1.0	μA
I_{GSS}	Gate to Body Leakage Current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.0	-1.6	-2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance(3)	$V_{GS}=-10\text{V}$, $I_D=-8\text{A}$	-	34	44	m Ω
		$V_{GS}=-4.5\text{V}$, $I_D=-5\text{A}$	-	46	62	m Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS}=-20\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$	-	1034	-	pF
C_{oss}	Output Capacitance		-	107	-	pF
C_{rss}	Reverse Transfer Capacitance		-	79.5	-	pF
Q_g	Total Gate Charge	$V_{DS}=-20\text{V}$, $I_D=-5\text{A}$, $V_{GS}=-10\text{V}$	-	20	-	nC
Q_{gs}	Gate-Source Charge		-	3.5	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	4.2	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{DS}=-20\text{V}$, $I_D=-5\text{A}$, $V_{GS}=-10\text{V}$, $R_{REN}=2.5\Omega$	-	8	-	ns
t_r	Turn-on Rise Time		-	15	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	23	-	ns
t_f	Turn-off Fall Time		-	9	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-10	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-40	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS}=0\text{V}$, $I_S=-10\text{A}$	-	-0.8	-1.2	V
t_{rr}	Body Diode Reverse Recovery Time	$T_J=25^{\circ}\text{C}$, $I_F=10\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$	-	29	-	ns
Q_{rr}	Body Diode Reverse Recovery		-	20	-	nC



Typical Performance Characteristics-N

Figure 1: Output Characteristics

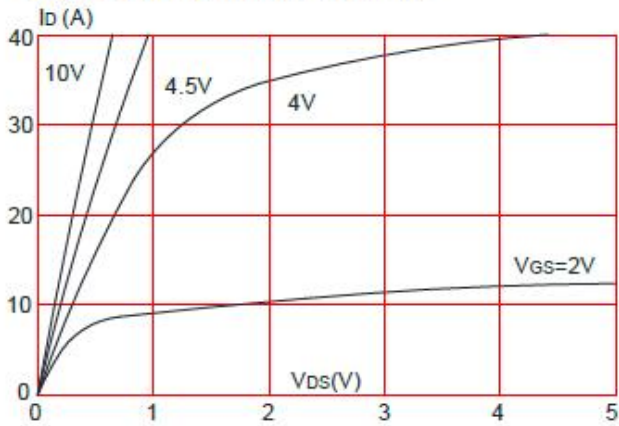


Figure 2: Typical Transfer Characteristics

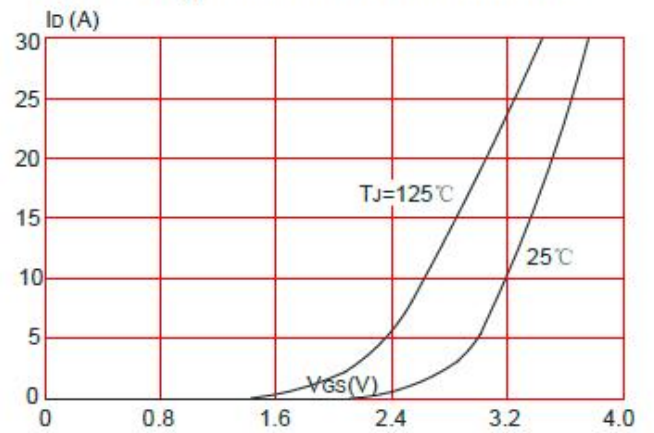


Figure 3: On-resistance vs. Drain Current

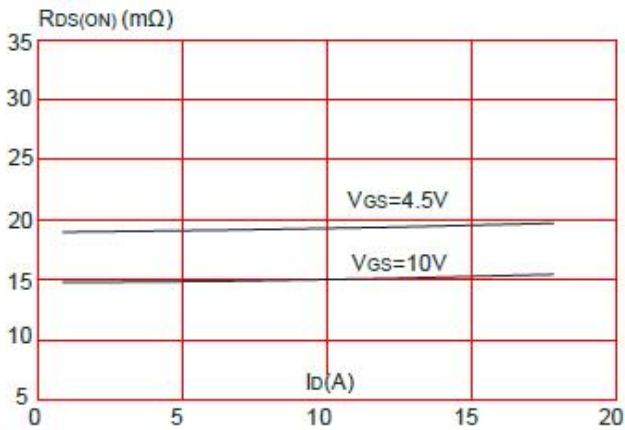


Figure 4: Body Diode Characteristics

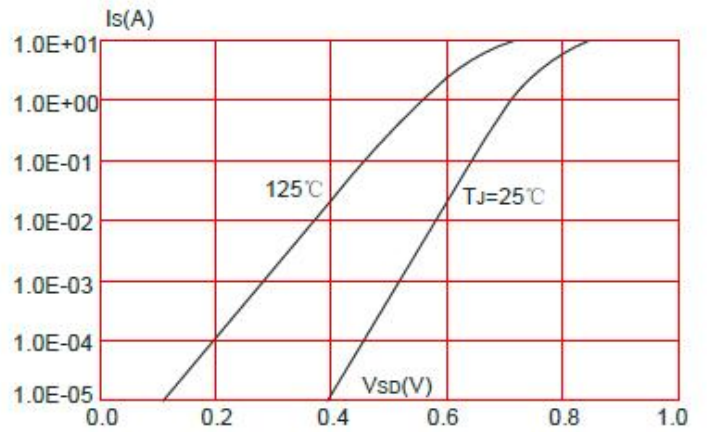


Figure 5: Gate Charge Characteristics

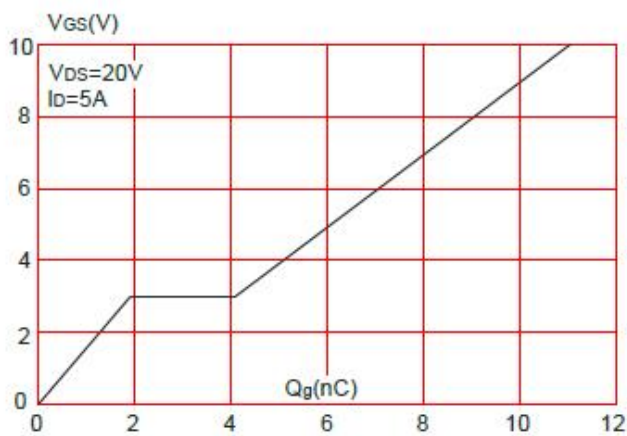


Figure 6: Capacitance Characteristics

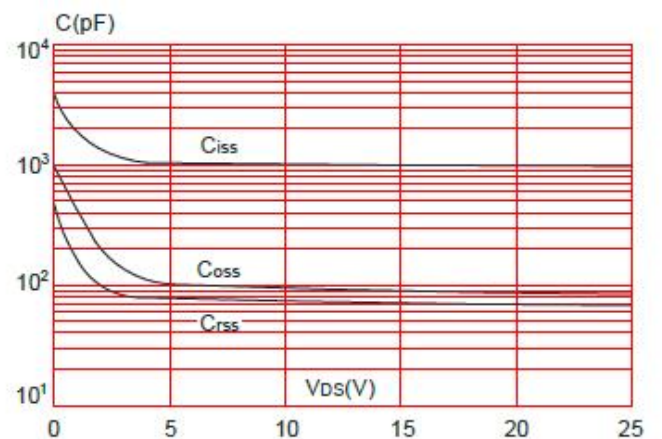




Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

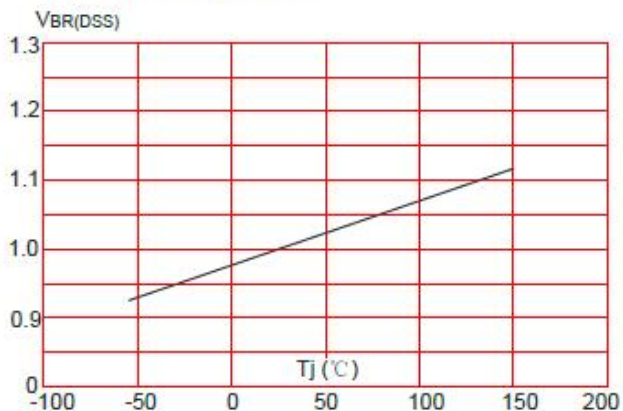


Figure 8: Normalized on Resistance vs. Junction Temperature

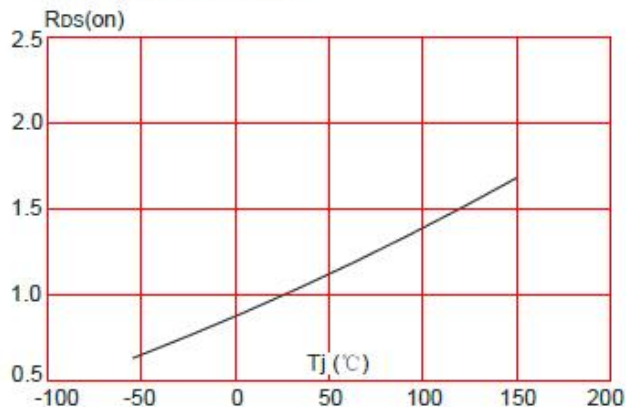


Figure 9: Maximum Safe Operating Area

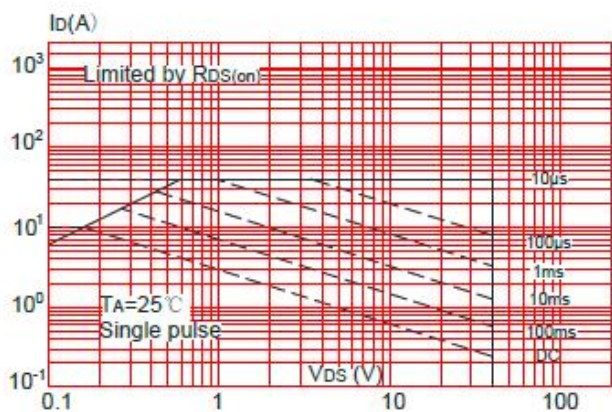


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

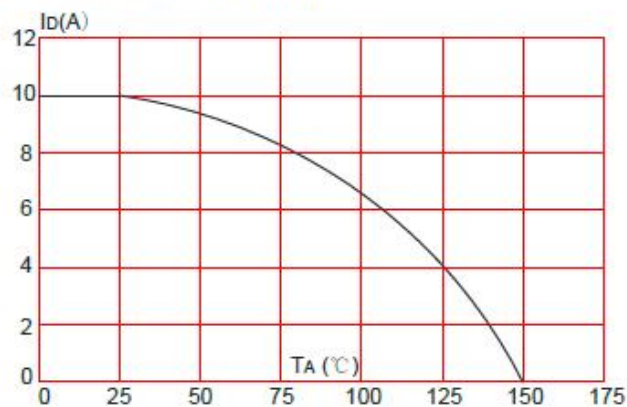
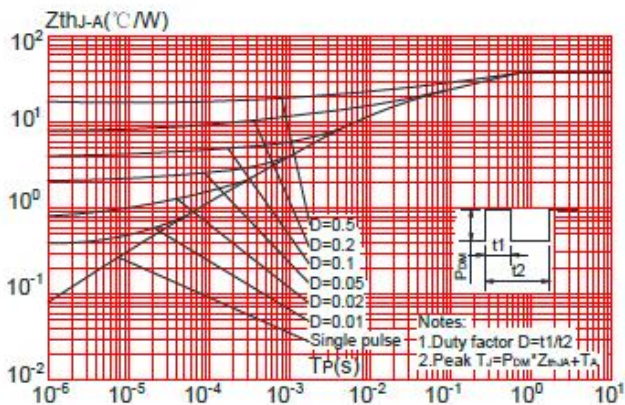


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



Test Circuit-N

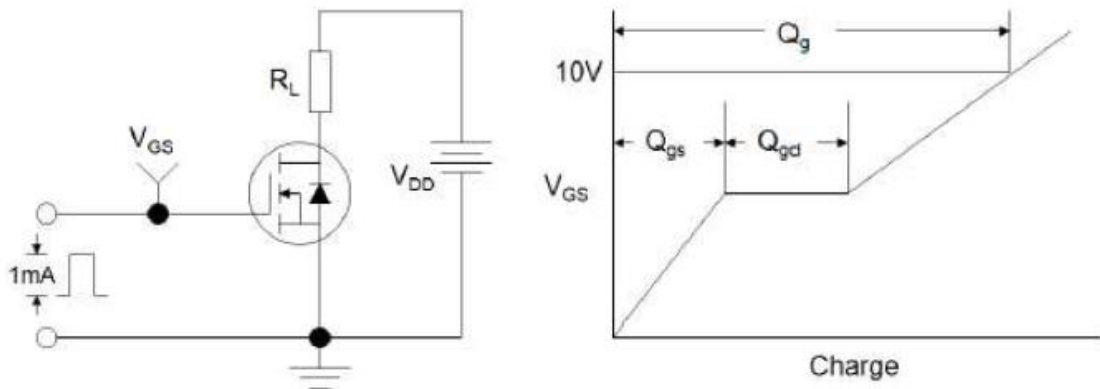


Figure 1: Gate Charge Test Circuit & Waveform

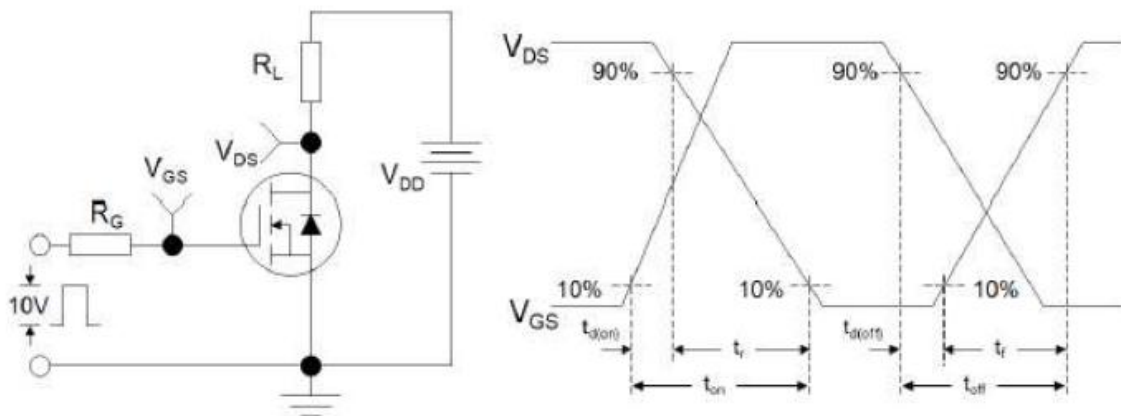


Figure 2: Resistive Switching Test Circuit & Waveforms

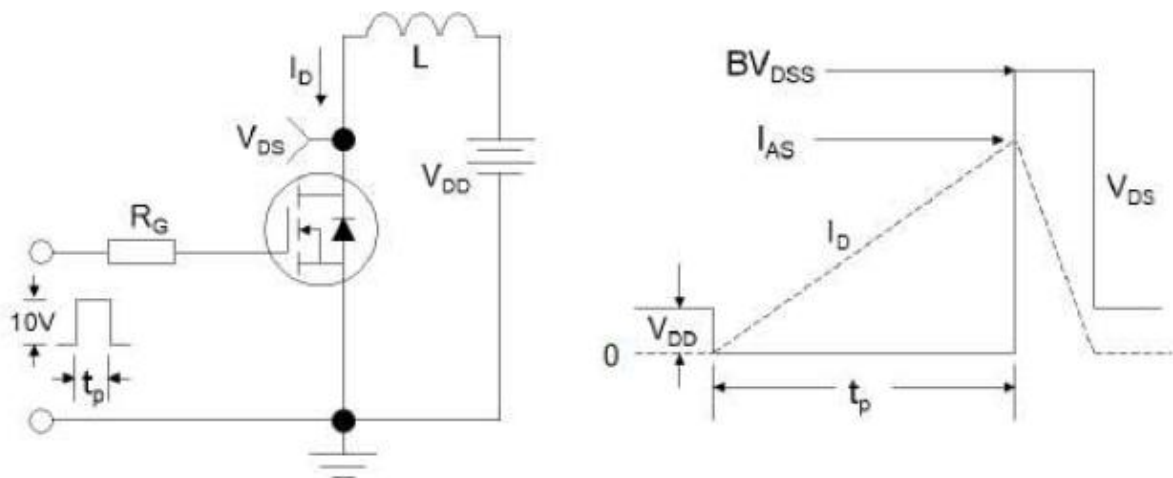


Figure 3: Unclamped Inductive Switching Test Circuit & Waveforms



Typical Performance Characteristics-P

Figure 1: Output Characteristics

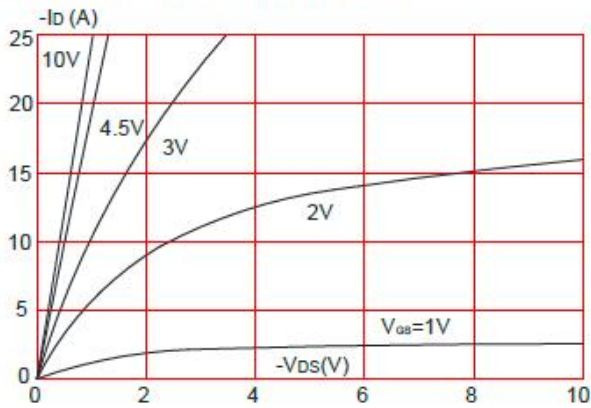


Figure 2: Typical Transfer Characteristics

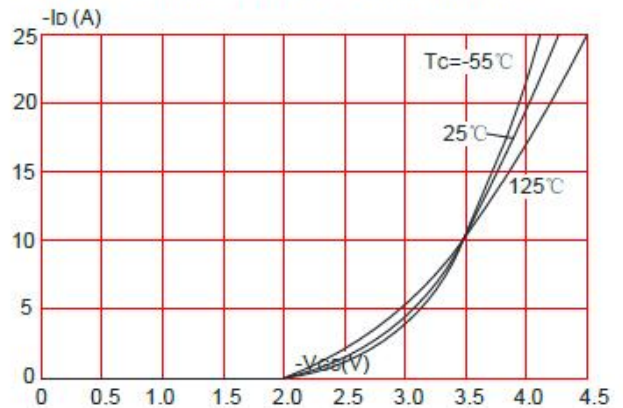


Figure 3: On-resistance vs. Drain Current

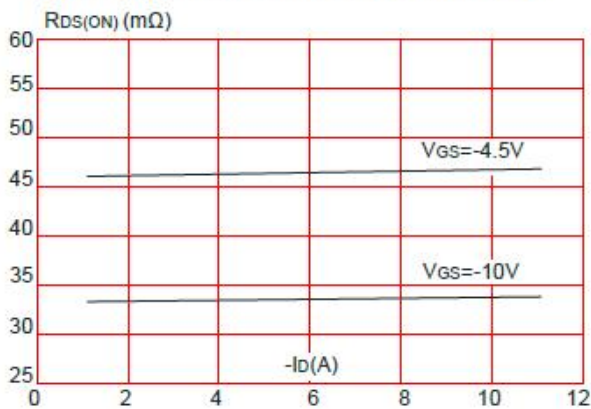


Figure 4: Body Diode Characteristics

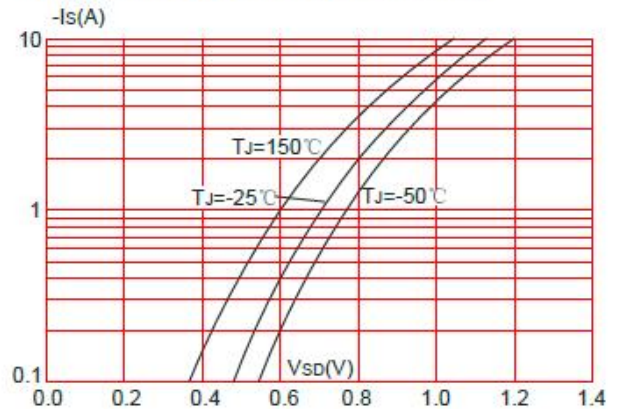


Figure 5: Gate Charge Characteristics

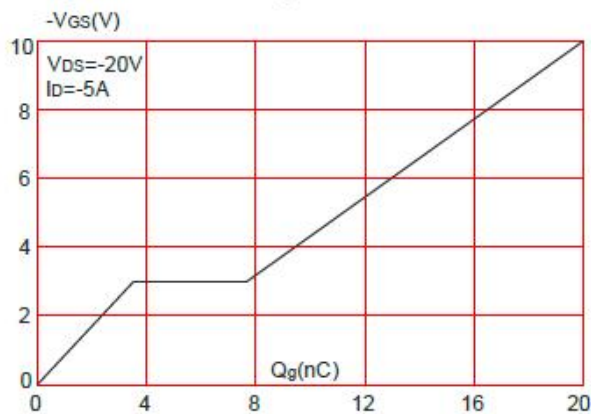


Figure 6: Capacitance Characteristics

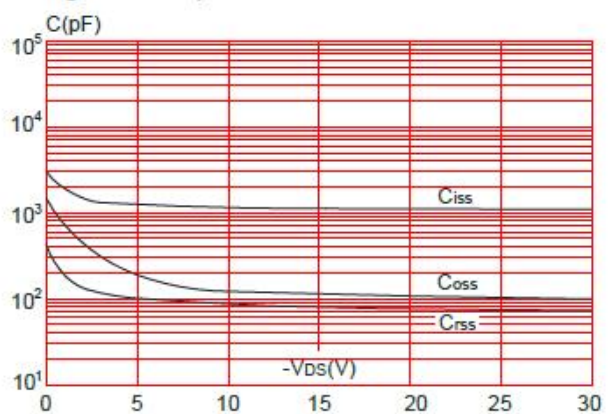




Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

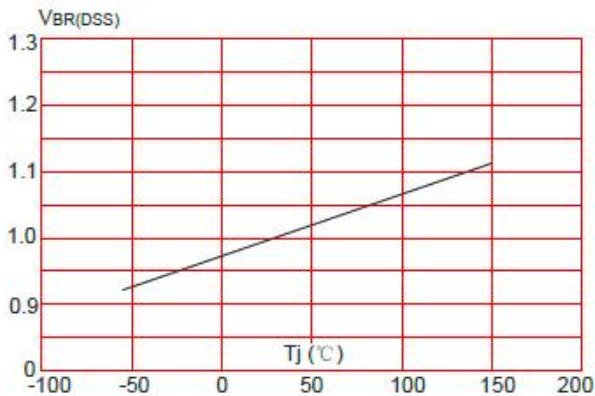


Figure 8: Normalized on Resistance vs. Junction Temperature

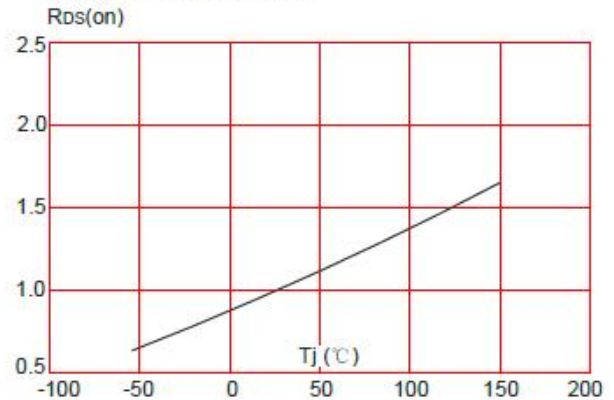


Figure 9: Maximum Safe Operating Area

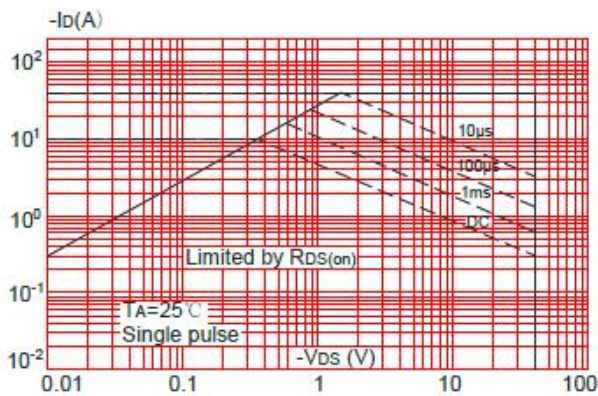


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

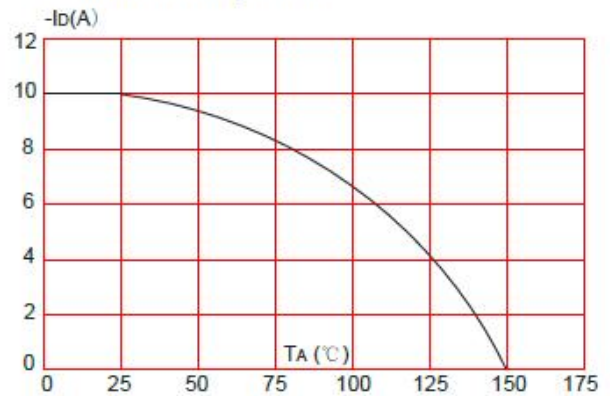
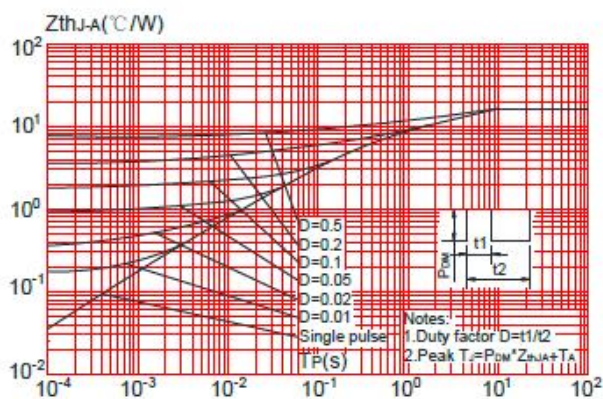
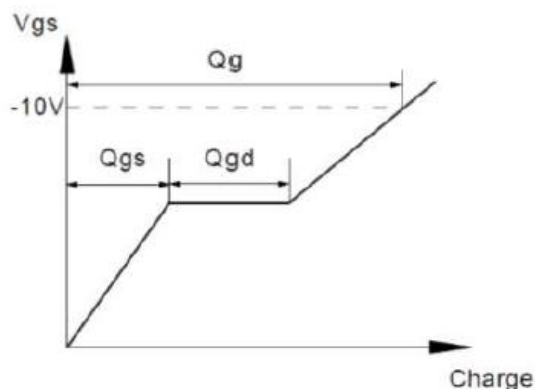
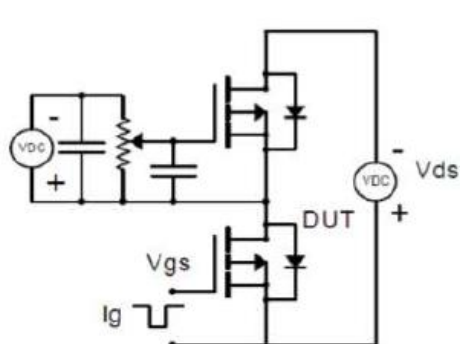


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

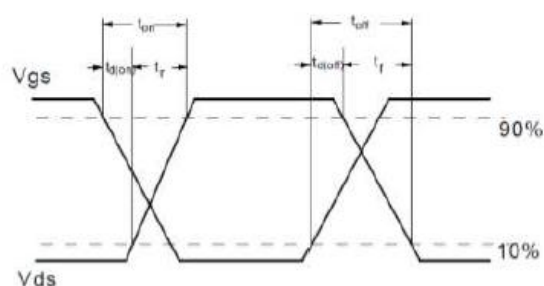
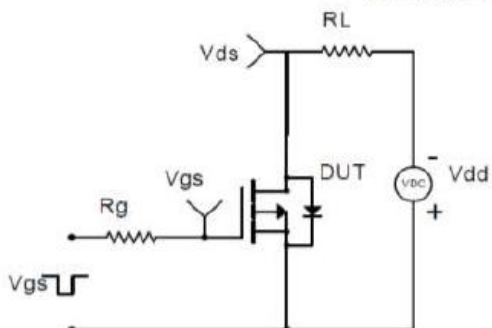


Test Circuit-P

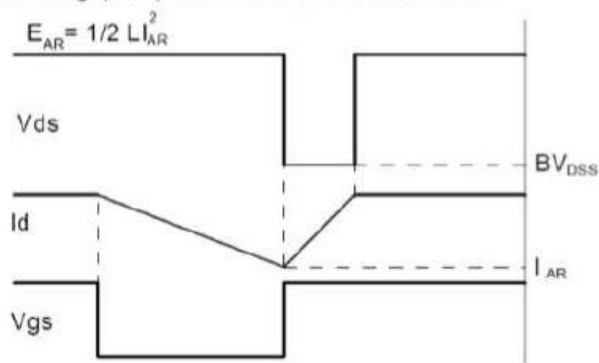
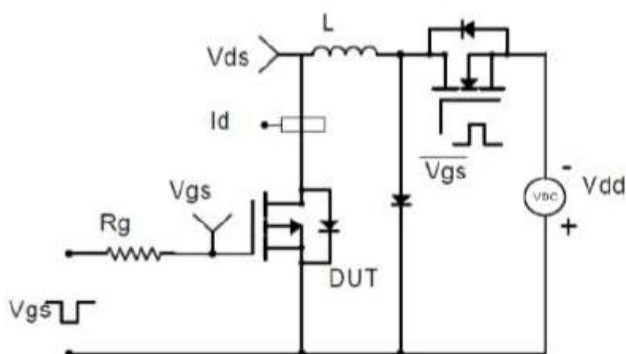
Gate Charge Test Circuit & Waveform



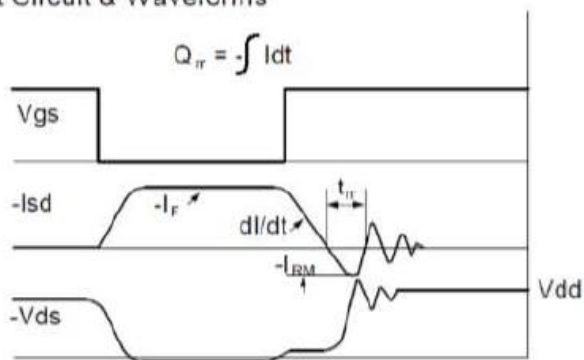
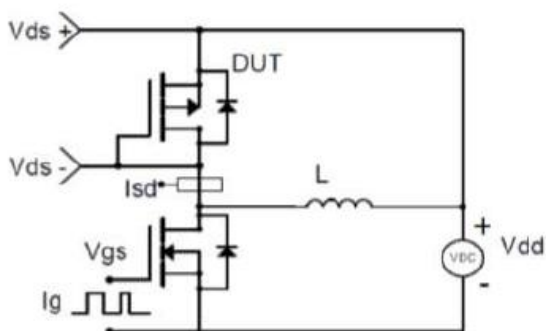
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

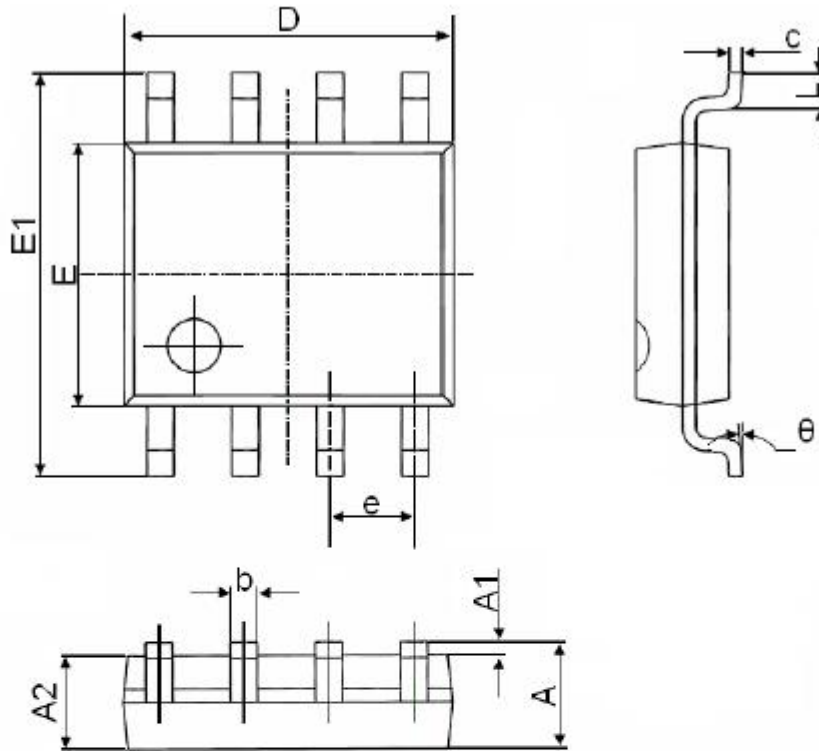


Diode Recovery Test Circuit & Waveforms



Package Dimensions

➤ SOP-8



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°



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