

N&P-Channel V Complementary MOSFET

Description

The HM609AK uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

N channel

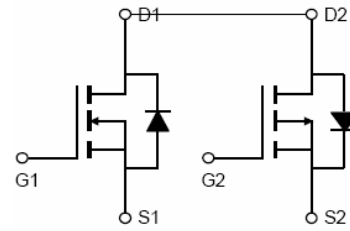
- $V_{DS} = 40V, I_D = 40A$
 $R_{DS(ON)} = 17.5m\Omega$ (Typ) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 21.5m\Omega$ (Typ) @ $V_{GS} = 4.5V$

p channel

- $V_{DS} = -40V, I_D = -25A$
 $R_{DS(ON)} = 31m\Omega$ (Typ) @ $V_{GS} = -10V$
 $R_{DS(ON)} = 43m\Omega$ (Typ) @ $V_{GS} = -4.5V$
- High density cell design for ultra low $R_{DS(ON)}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- H-bridge
- Inverters



Schematic diagram



Marking and pin assignment

100% UIS TESTED!

100% ΔV_d s TESTED!

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
HM609AK	HM609AK	TO-252-4L	-	-	-

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

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	40	-40	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	40	-25	A
		28	-17.5	
Pulsed Drain Current ^(Note 1)	I_{DM}	120	-75	A
Maximum Power Dissipation	P_D	21		W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175		$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{\theta JC}$	7	$^\circ C/W$
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N-Channel Electrical Characteristics ($T_C=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =40V,V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250μA	1.0	1.7	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =7A	-	17.5	22.5	mΩ
		V _{GS} =4.5V, I _D =6A	-	21.5	30	mΩ
Forward Transconductance	g _{FS}	V _{DS} =10V,I _D =7A	-	29	-	S
Dynamic Characteristics ^(Note4)						
Input Capacitance	C _{iss}	V _{DS} =15V,V _{GS} =0V, F=1.0MHz	-	450	-	PF
Output Capacitance	C _{oss}		-	150	-	PF
Reverse Transfer Capacitance	C _{rss}		-	90	-	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V ,R _L =2.5Ω V _{GS} =10V,R _G =3Ω	-	5	-	nS
Turn-on Rise Time	t _r		-	12	-	nS
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS
Turn-Off Fall Time	t _f		-	6	-	nS
Total Gate Charge	Q _g	V _{DS} =15V,I _D =6A, V _{GS} =10V	-	9.5		nC
Gate-Source Charge	Q _{gs}		-	2.0		nC
Gate-Drain Charge	Q _{gd}		-	1.9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V _{SD}	V _{GS} =0V,I _S =40A	-		1.2	V
Diode Forward Current ^(Note 2)	I _S		-	-	40	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition: $T_J=25^{\circ}\text{C}$, $V_{DD}=40V$, $V_G=10V$, $L=0.5mH$, $R_g=25\Omega$

N-Channel Typical Electrical and Thermal Characteristics (Curves)

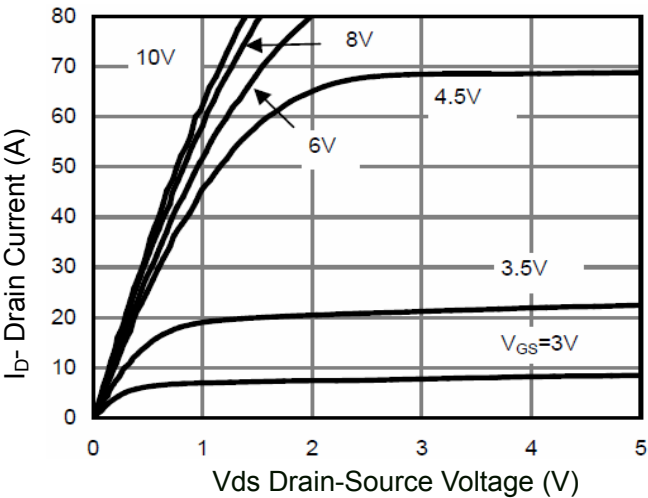


Figure 1 Output Characteristics

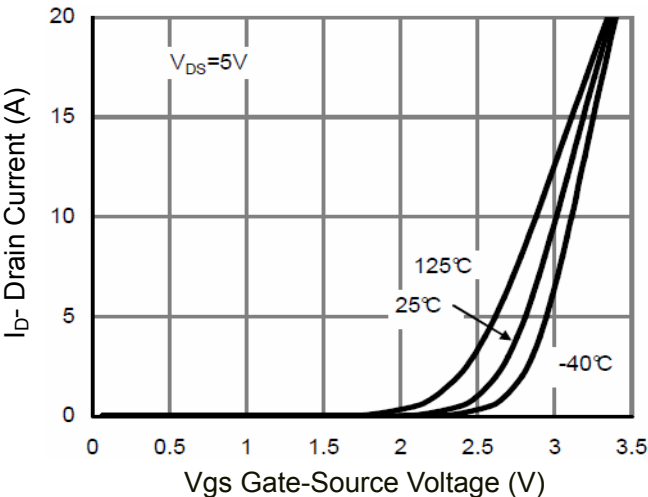


Figure 2 Transfer Characteristics

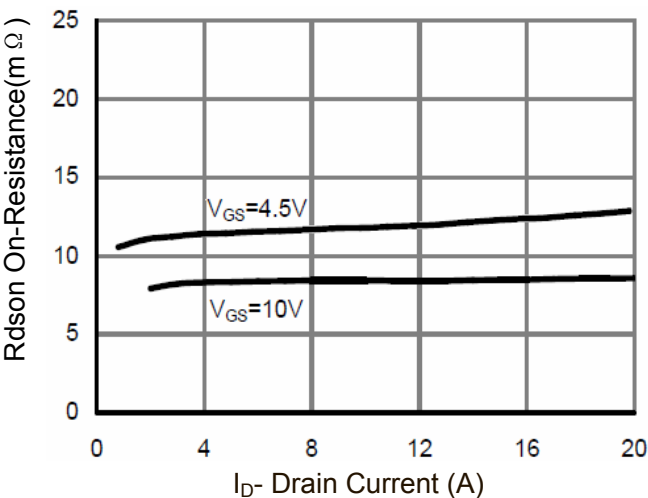


Figure 3 $R_{DS(on)}$ - Drain Current

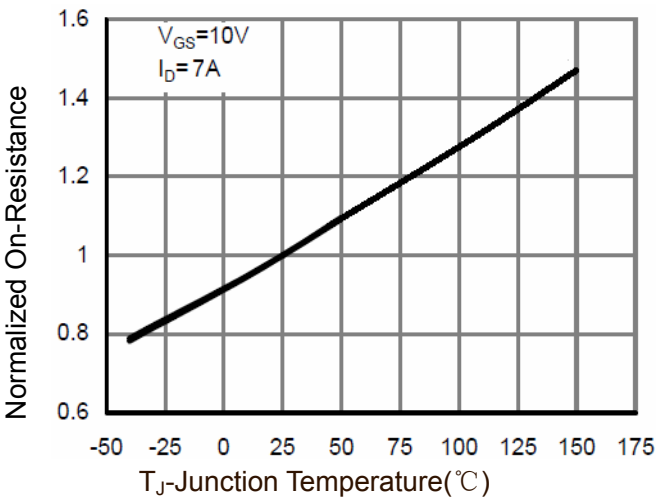


Figure 4 $R_{DS(on)}$ -Junction Temperature

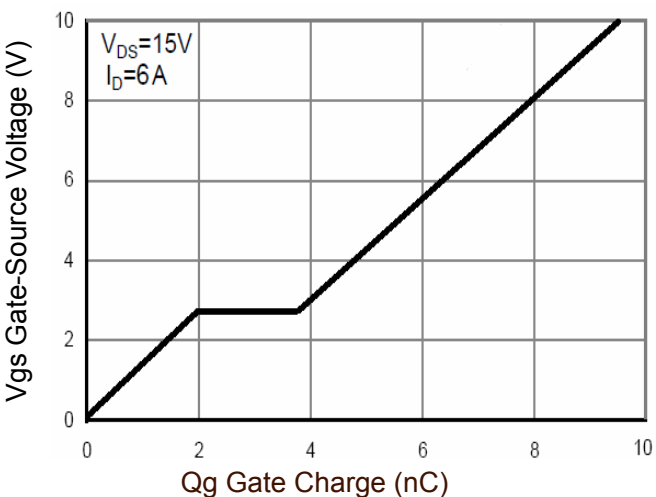


Figure 5 Gate Charge

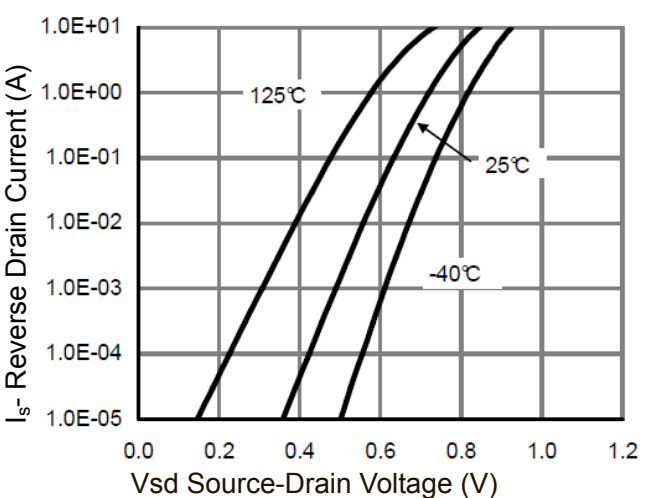


Figure 6 Source- Drain Diode Forward

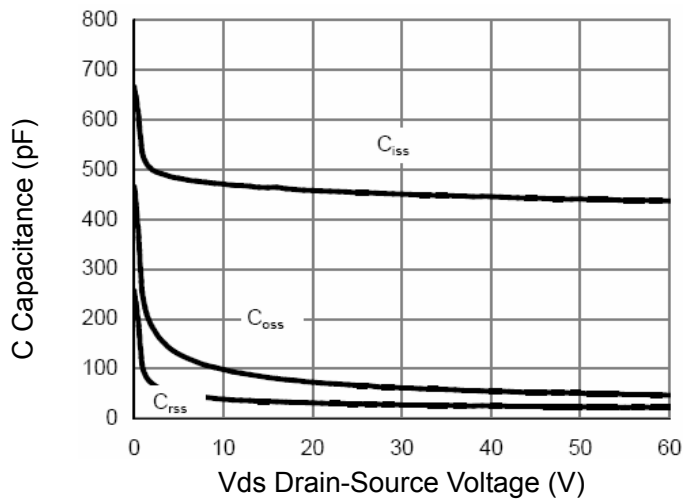


Figure 7 Capacitance vs Vds

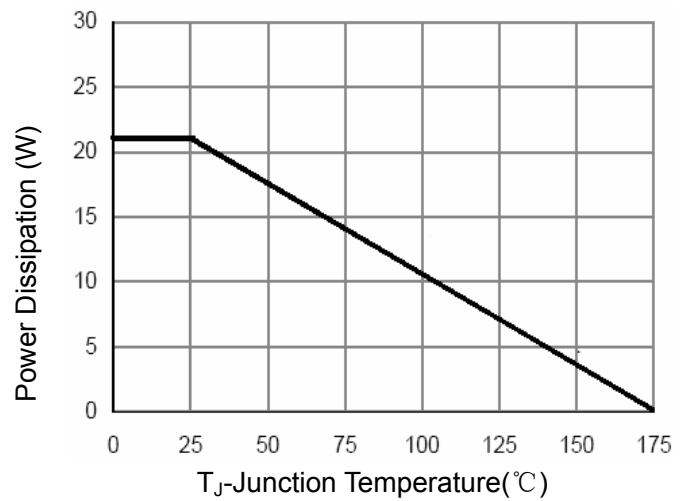


Figure 9 Power De-rating

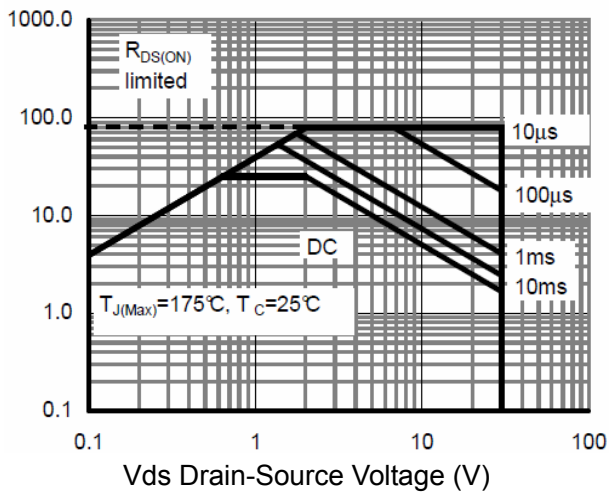


Figure 8 Safe Operation Area

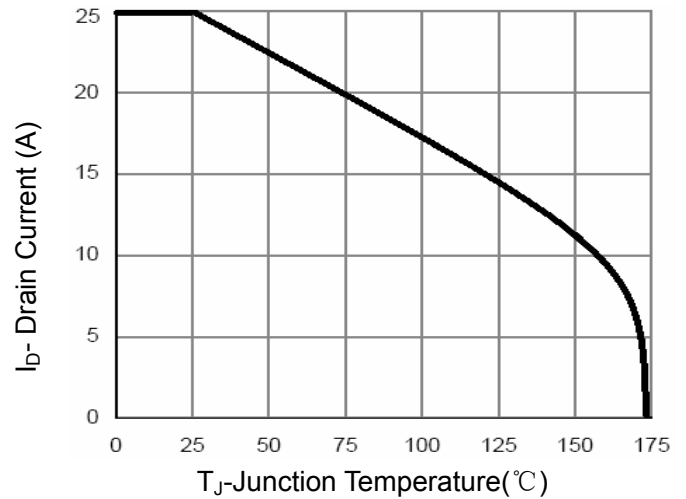


Figure 10 Current De-rating

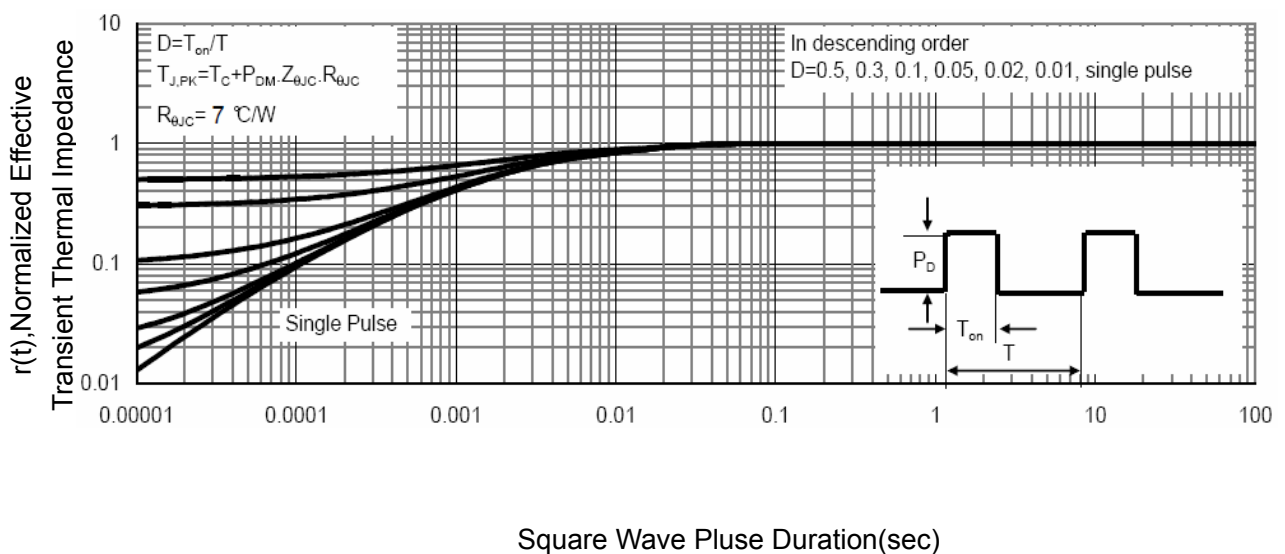


Figure 11 Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T_C=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =-250μA	-40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-40V, V _{GS} =0V	-	-	-1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-1.0	-1.6	-2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-6A	-	31	39	mΩ
		V _{GS} =-4.5V, I _D =-5A		43	56	
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-6A	-	15	-	S
Dynamic Characteristics ^(Note4)						
Input Capacitance	C _{ISS}	V _{DS} =-40V, V _{GS} =0V, F=1.0MHz	-	920	-	PF
Output Capacitance	C _{OSS}		-	140	-	PF
Reverse Transfer Capacitance	C _{RSS}		-	90	-	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-15V ,R _L =2.5Ω V _{GS} =-10V, R _G =3Ω	-	8	-	nS
Turn-on Rise Time	t _r		-	30	-	nS
Turn-Off Delay Time	t _{d(off)}		-	22	-	nS
Turn-Off Fall Time	t _f		-	26	-	nS
Total Gate Charge	Q _g	V _{DS} =-15V, I _D =-6A, V _{GS} =-10V	-	16.2		nC
Gate-Source Charge	Q _{gs}		-	2.9		nC
Gate-Drain Charge	Q _{gd}		-	3.6		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V _{SD}	V _{GS} =0V, I _S =-6A	-		-1.2	V
Diode Forward Current ^(Note 2)	I _S		-	-	-25	A
Reverse Recovery Time	t _{rr}	TJ = 25°C, IF =-6A	-	23	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs ^(Note3)	-	14	-	nC

P-Channel Typical Electrical and Thermal Characteristics (Curves)

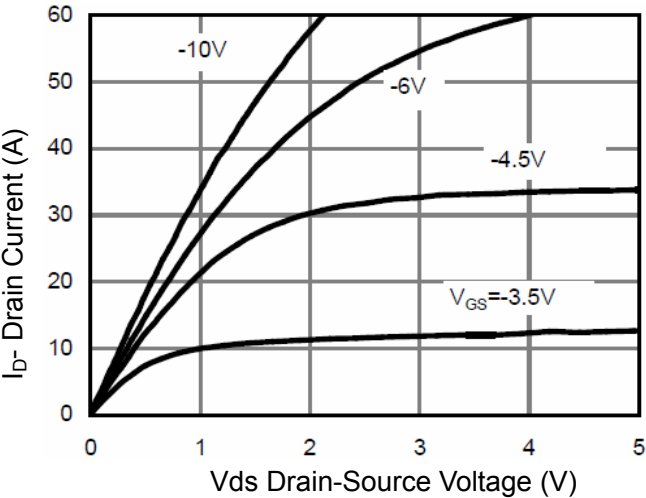


Figure 1 Output Characteristics

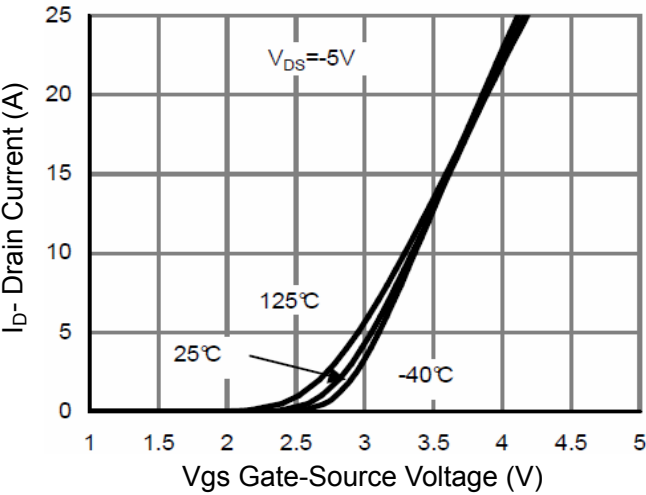


Figure 2 Transfer Characteristics

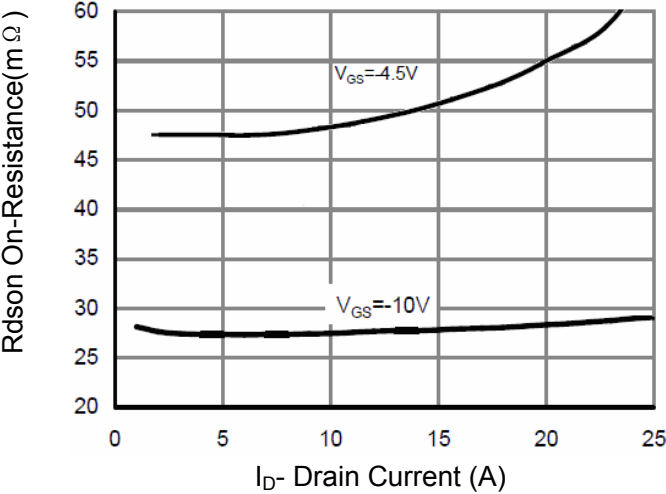


Figure 3 $R_{DS(on)}$ - Drain Current

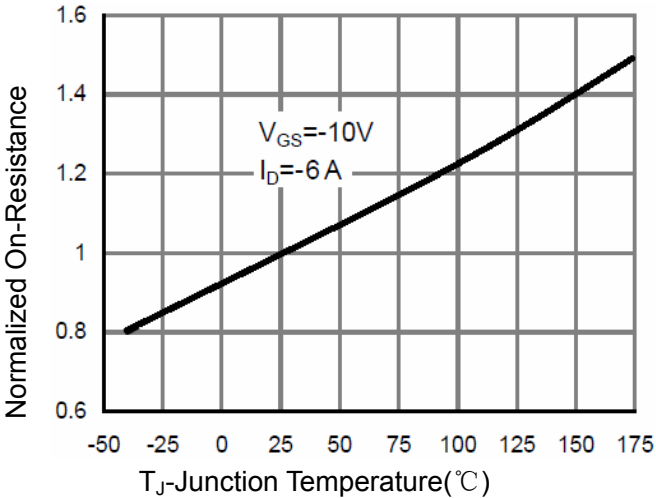


Figure 4 $R_{DS(on)}$ -Junction Temperature

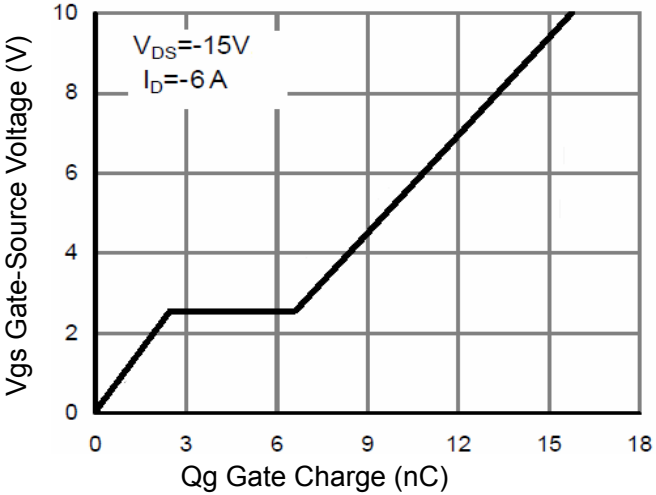


Figure 5 Gate Charge

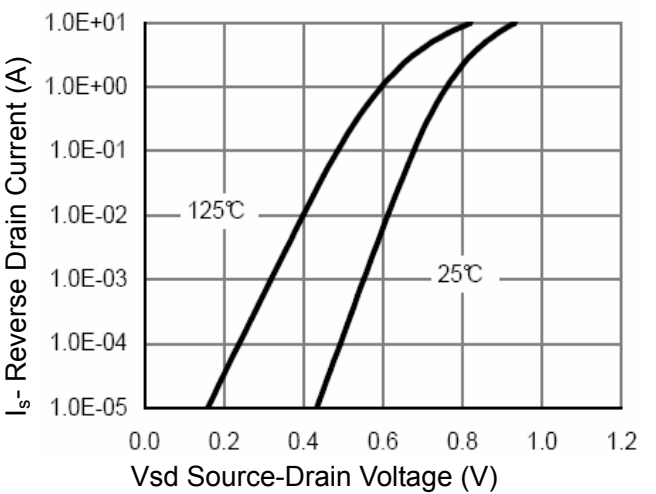


Figure 6 Source- Drain Diode Forward

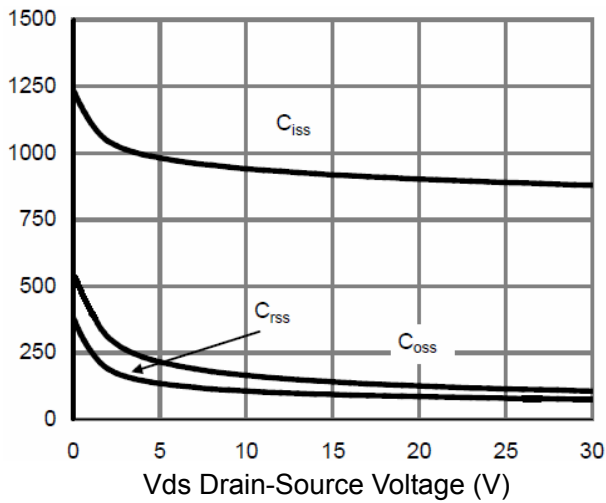


Figure 7 Capacitance vs Vds

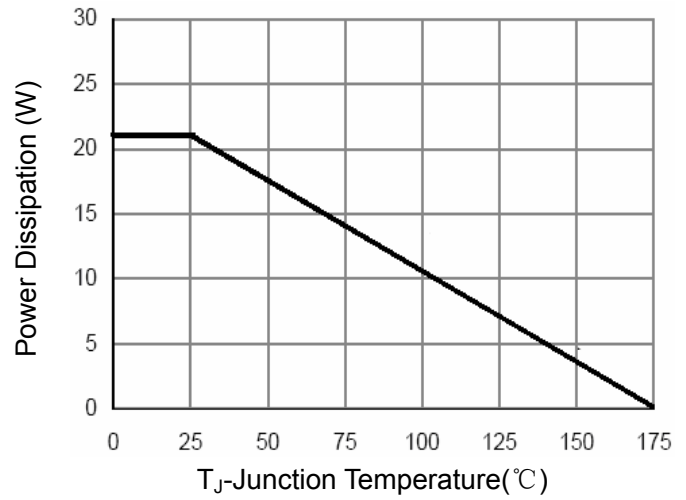


Figure 9 Power De-rating

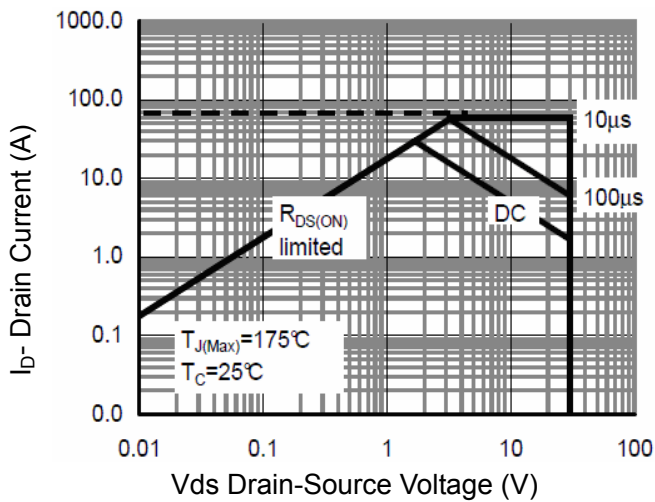


Figure 8 Safe Operation Area

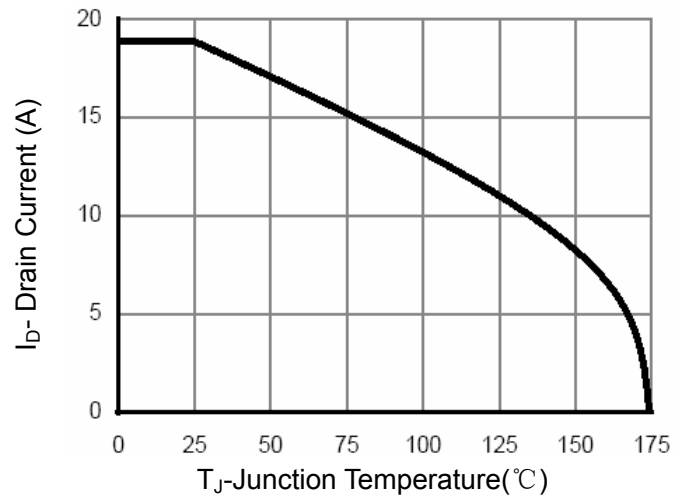


Figure 10 Current De-rating

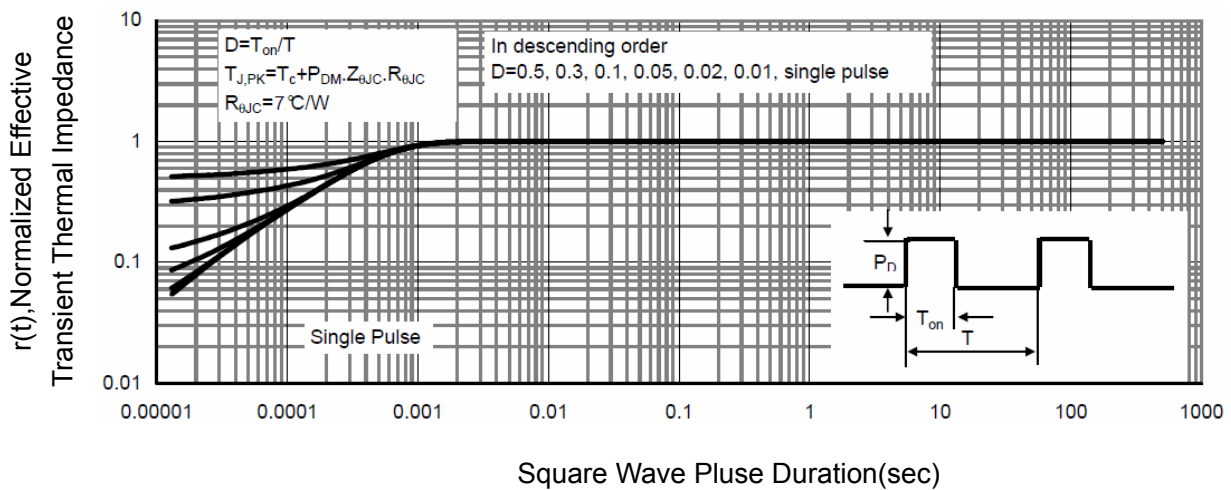
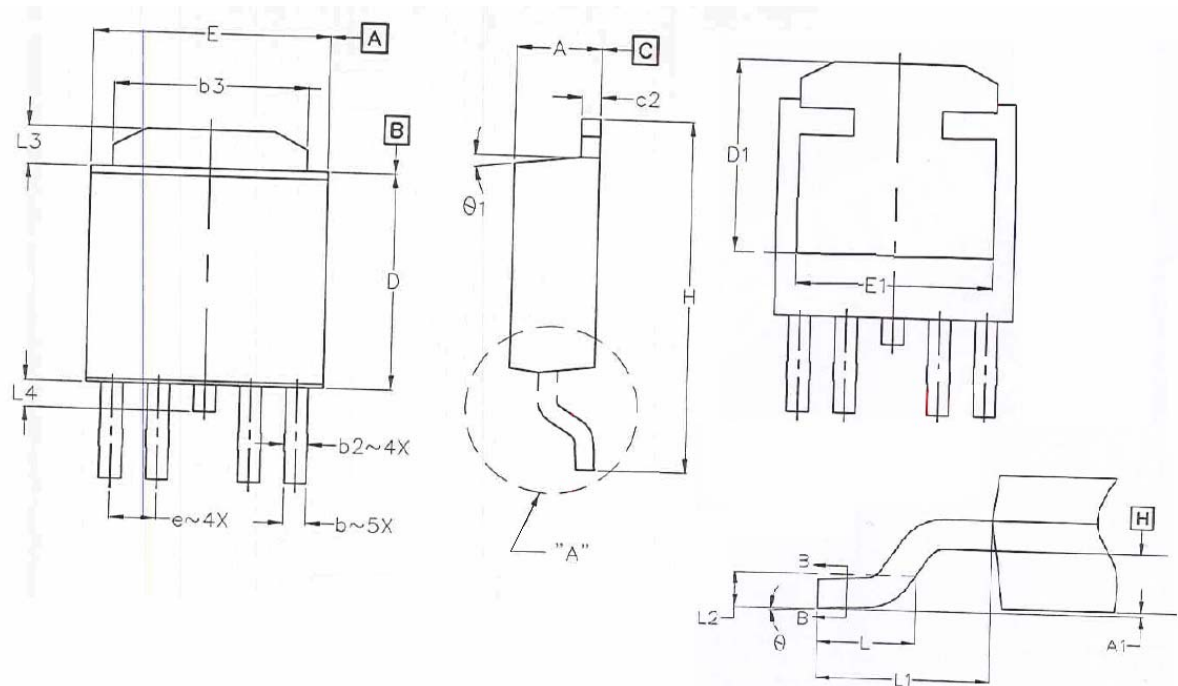


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-4L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.184	2.387	0.086	0.094
A1	-	0.127	-	0.094
b	0.508	0.711	0.020	0.028
b1	0.508	0.660	0.020	0.026
b2	0.610	0.787	0.024	0.031
b3	4.953	5.461	0.195	0.215
c	0.460	0.610	0.018	0.024
c1	0.410	0.559	0.016	0.022
C2	0.460	12.950	0.498	0.510
D	4.980	5.180	0.196	0.204
D1	2.650	2.950	0.104	0.116
E	7.900	8.100	0.311	0.319
E1	0.000	0.300	0.000	0.012
e	12.900	13.400	0.508	0.528
H	2.850	3.250	0.112	0.128
L	1.397	1.778	0.055	0.070
L1	2.743	BSC	0.108	BSC
L2	0.508	BSC	0.020	BSC
L3	0.889	1.270	0.035	0.050
L4	-	1.015	-	0.040
θ	0°	10°	0°	10°
θ 1	0°	15°	0°	15°