

# MSKSEMI

SEMICONDUCTOR



ESD



TVS



TSS



MOV



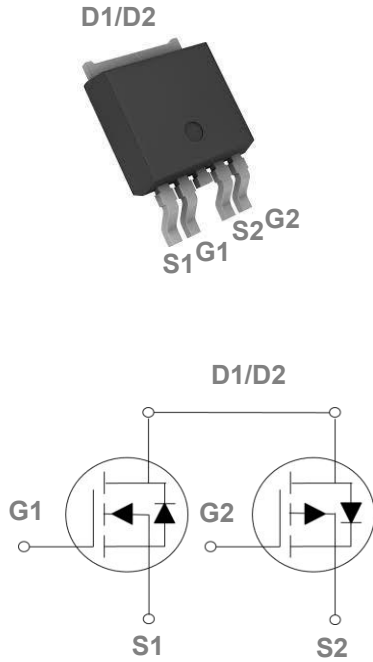
GDT



PLED

Product data sheet

**TO252-4 Pin Configuration**



**Features**

- Fast switching
- Green Device Available
- Suit for 4.5V Gate Drive Applications

**Applications**

- DC Fan
- Motor Drive Applications
- Networking
- Half / Full Bridge Topology

BVDSS	RDSON	ID
40V	19mΩ	15A
-40V	38mΩ	-12A

**Absolute Maximum Ratings** Tc=25°C unless otherwise noted

Symbol	Parameter	Rating		Units
V <sub>DS</sub>	Drain-Source Voltage	40	-40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	±20	V
I <sub>D</sub>	Drain Current – Continuous (T <sub>C</sub> =25°C)	15	-12	A
	Drain Current – Continuous (T <sub>C</sub> =100°C)	9	-7	A
I <sub>DM</sub>	Drain Current – Pulsed <sup>1</sup>	60	-48	A
P <sub>D</sub>	Power Dissipation (T <sub>C</sub> =25°C)	20		W
	Power Dissipation – Derate above 25°C	0.16		W/°C
T <sub>STG</sub>	Storage Temperature Range	-55 to 150		°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150		°C

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJC</sub>	Thermal Resistance Junction to Case	---	6	°C/W
R <sub>θJA</sub>	Thermal Resistance Junction to Ambient	---	62	°C/W

**N-CH Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise)**
**Off Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V , I <sub>D</sub> =250uA	40	---	---	V
OBV <sub>DSS</sub> /OT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C , I <sub>D</sub> =1mA	---	0.04	---	V/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =40V , V <sub>GS</sub> =0V , T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =32V , V <sub>GS</sub> =0V , T <sub>J</sub> =125°C	---	---	10	uA
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V , V <sub>DS</sub> =0V	---	---	±100	nA

**On Characteristics**

R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V , I <sub>D</sub> =6A	---	19	30	mΩ
		V <sub>GS</sub> =4.5V , I <sub>D</sub> =4A	---	30	42	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.0	1.5	2.5	V
OV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	-3	---	mV/°C
gfs	Forward Transconductance	V <sub>DS</sub> =10V , I <sub>D</sub> =3A	---	6.5	---	S

**Dynamic and switching Characteristics**

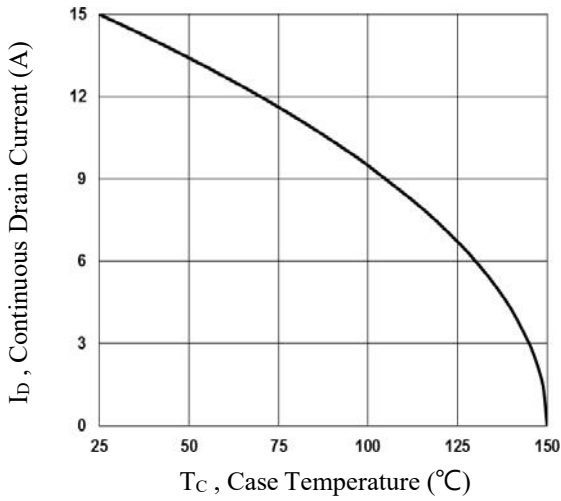
Q <sub>g</sub>	Total Gate Charge <sup>2, 3</sup>	V <sub>DS</sub> =20V , V <sub>GS</sub> =4.5V , I <sub>D</sub> =6A	---	5.2		nC
Q <sub>gs</sub>	Gate-Source Charge <sup>2, 3</sup>		---	1.2		
Q <sub>gd</sub>	Gate-Drain Charge <sup>2, 3</sup>		---	2.5		
T <sub>d(on)</sub>	Turn-On Delay Time <sup>2, 3</sup>	V <sub>DD</sub> =20V , V <sub>GS</sub> =4.5V , R <sub>G</sub> =25Ω I <sub>D</sub> =1A	---	3.2		ns
T <sub>r</sub>	Rise Time <sup>2, 3</sup>		---	8.6		
T <sub>d(off)</sub>	Turn-Off Delay Time <sup>2, 3</sup>		---	18		
T <sub>f</sub>	Fall Time <sup>2, 3</sup>		---	6		
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V , V <sub>GS</sub> =0V , F=1MHz	---	420		pF
C <sub>oss</sub>	Output Capacitance		---	65		
C <sub>rss</sub>	Reverse Transfer Capacitance		---	40		

**Drain-Source Diode Characteristics and Maximum Ratings**

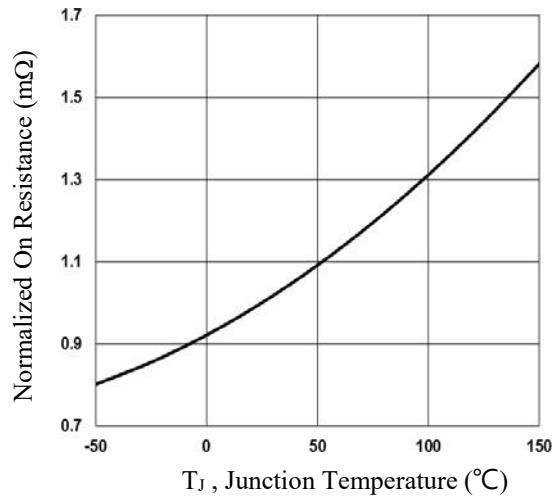
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V , Force Current	---	---	15	A
I <sub>SM</sub>	Pulsed Source Current		---	---	30	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V , I <sub>S</sub> =1A , T <sub>J</sub> =25°C	---	---	1	V

Note :

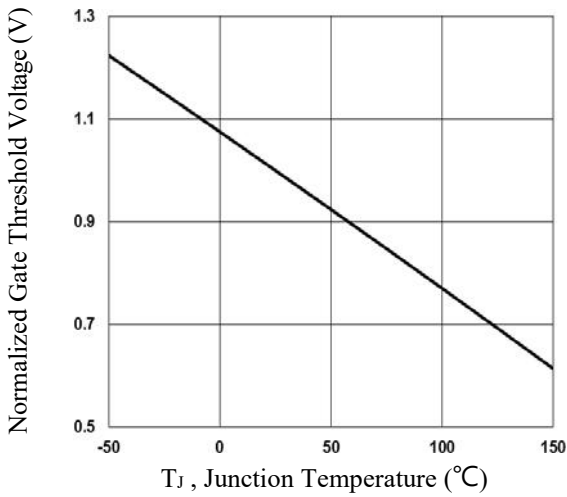
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
3. Essentially independent of operating temperature.



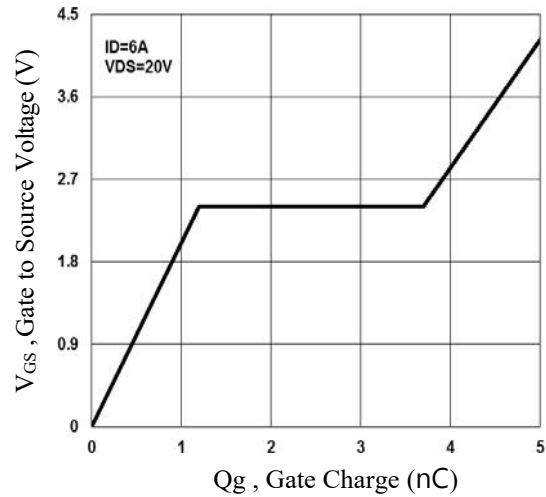
**Fig.1 Continuous Drain Current vs. T<sub>c</sub>**



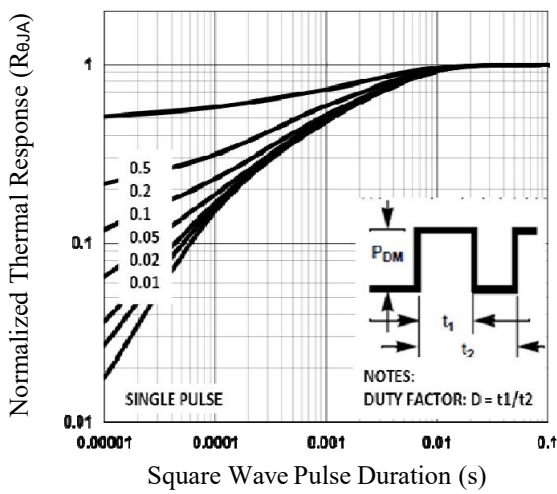
**Fig.2 Normalized RDS(on) vs. T<sub>j</sub>**



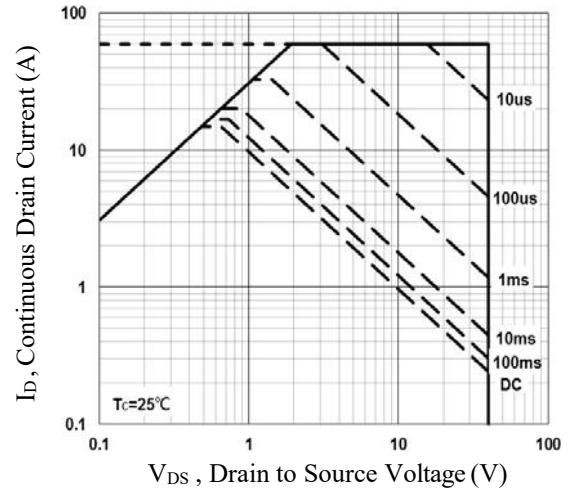
**Fig.3 Normalized V<sub>th</sub> vs. T<sub>j</sub>**



**Fig.4 Gate Charge Waveform**



**Fig.5 Normalized Transient Impedance**



**Fig.6 Maximum Safe Operation Area**

**P-CH Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise)**
**Off Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-40	---	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.04	---	V/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	-1	uA
		V <sub>DS</sub> =-32V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C	---	---	-10	uA
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±10V, V <sub>DS</sub> =0V	---	---	±100	nA

**On Characteristics**

R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5A	---	38	45	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A	---	45	70	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	-1.5	-2.5	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	3	---	mV/°C
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-10V, I <sub>D</sub> =-3A	---	9	---	S

**Dynamic and switching Characteristics**

Q <sub>g</sub>	Total Gate Charge <sup>2, 3</sup>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A	---	9		nC
Q <sub>gs</sub>	Gate-Source Charge <sup>2, 3</sup>		---	2.5		
Q <sub>gd</sub>	Gate-Drain Charge <sup>2, 3</sup>		---	3.2		
T <sub>d(on)</sub>	Turn-On Delay Time <sup>2, 3</sup>	V <sub>DD</sub> =-20V, V <sub>GS</sub> =-4.5V, R <sub>G</sub> =25Ω I <sub>D</sub> =-1A	---	20		ns
T <sub>r</sub>	Rise Time <sup>2, 3</sup>		---	12		
T <sub>d(off)</sub>	Turn-Off Delay Time <sup>2, 3</sup>		---	46		
T <sub>f</sub>	Fall Time <sup>2, 3</sup>		---	6		
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, F=1MHz	---	1050		pF
C <sub>oss</sub>	Output Capacitance		---	110		
C <sub>rss</sub>	Reverse Transfer Capacitance		---	80		

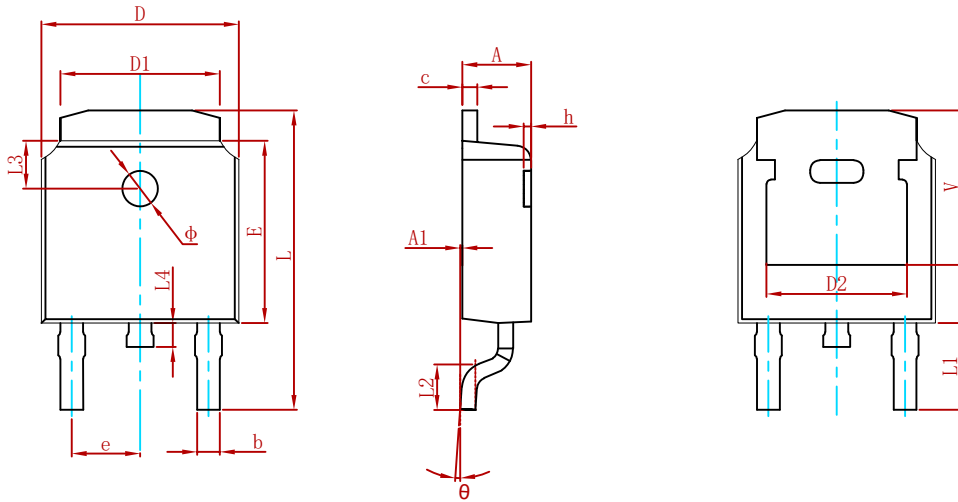
**Drain-Source Diode Characteristics and Maximum Ratings**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-12	A
I <sub>SM</sub>	Pulsed Source Current		---	---	-24	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1	V

Note :

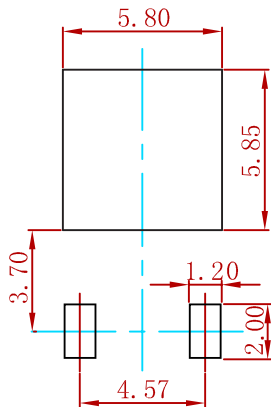
4. Repetitive Rating : Pulsed width limited by maximum junction temperature.
5. The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%.
6. Essentially independent of operating temperature.

**PACKAGE MECHANICAL DATA**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.635	0.770	0.025	0.030
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.712	10.312	0.382	0.406
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.250 REF.		0.207 REF.	

**Suggested Pad Layout**

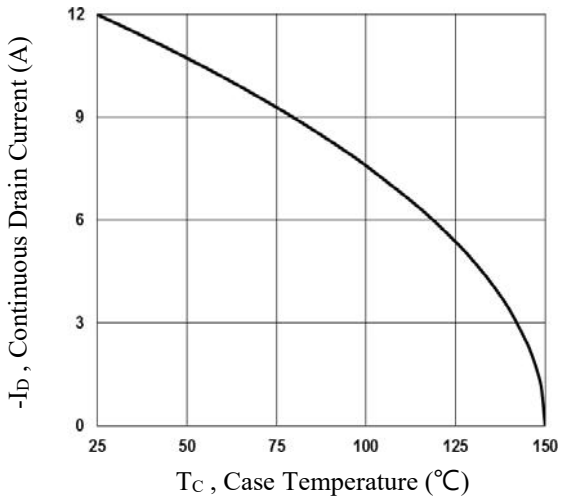


**Note:**

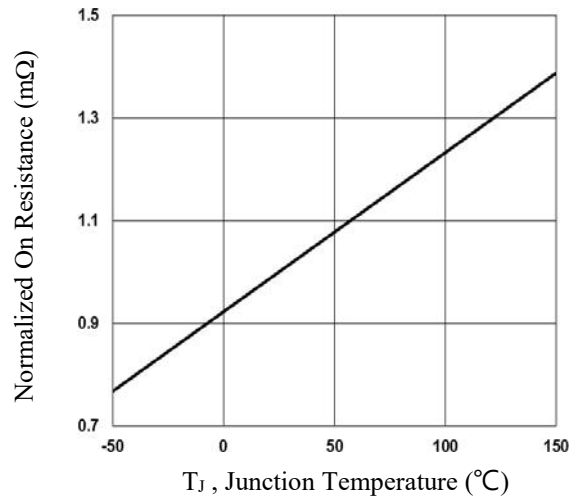
1. Controlling dimension: in millimeters.
2. General tolerance: ± 0.05mm.
3. The pad layout is for reference purposes only.

**REEL SPECIFICATION**

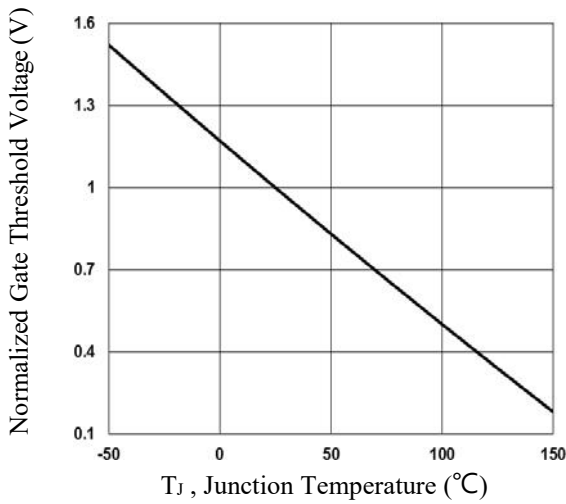
P/N	PKG	QTY
AOD609-MS	TO-252-4	2500



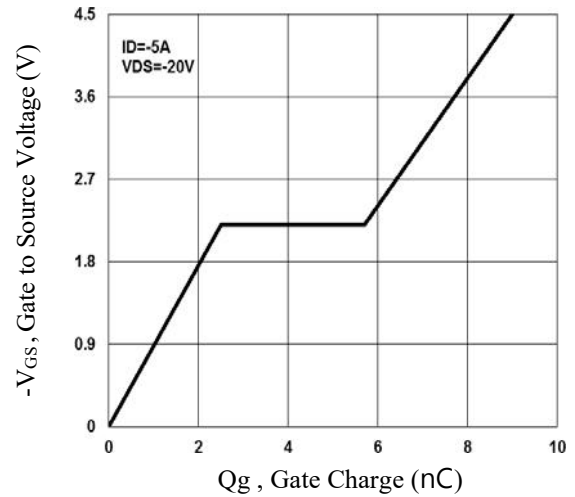
**Fig.7 Continuous Drain Current vs. T<sub>C</sub>**



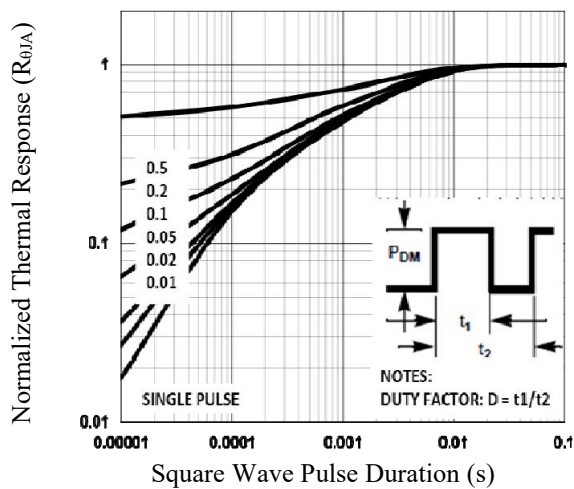
**Fig.8 Normalized RDS(on) vs. T<sub>J</sub>**



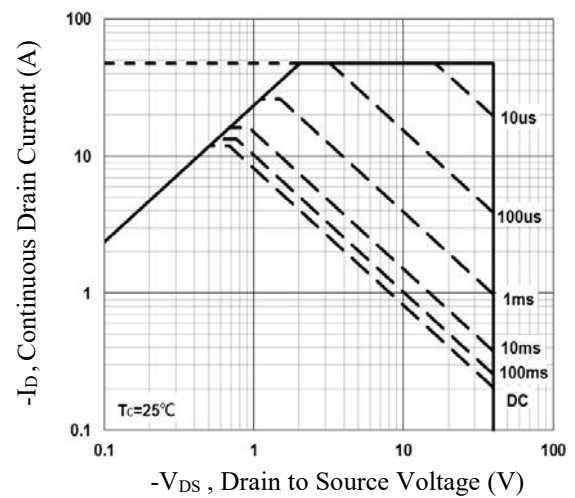
**Fig.9 Normalized V<sub>th</sub> vs. T<sub>J</sub>**



**Fig.10 Gate Charge Waveform**



**Fig.11 Normalized Transient Impedance**



**Fig.12 Maximum Safe Operation Area**

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