Power MOSFETS

DATASHEET

LM60346CAO4A

N-Channel AND P-Channel
Enhancement Mode MOSFET

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Quality Management Systems

ISO 9001:2015 Certificate

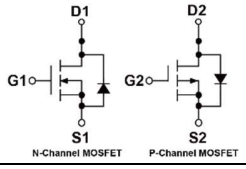
LM60346CAO4A

N-Channel AND P-Channel Enhancement Mode MOSFET

Pin Description

TO-252-4L (TOP view)

Symbol



Odering Information

Symbol	N-Channel	P-Channel	Unit
V_{DSS}	**60**	**-60**	**V**
$R_{DS(ON)-Max}$	**38**	**89**	**mΩ**
I_D	**21**	**-14**	**A**

Feature

- Reliable and Rugged
- ROHS Compliant & Halogen-Free
- Lower Q_g and Q_{gd} for high-speed switching
- Lower $R_{DS(ON)}$ to Minimize Conduction Loss
- 100% UIS Tested

Applications

- Motor Control
- Synchronous Rectification
- High Current Switching

Ordering Information

Orderable Part Number	Package Type	Form	Shipping	Marking
LM60346CAO4A	TO-252-4L	Tape & Reel	3000 / Tape & Reel	60346 □□□□□□

Note：□□□□□□ = Lot Code

Absolute Maximum Ratings (T_J=25°C Unless Otherwise Noted)

Symbol	Parameter		N-Channel	P- Channel	Unit
V_{DSS}	Drain-Source Voltage		60	-60	V
V_{GSS}	Gate-Source Voltage		±20	±20	
T_J	Maximum Junction Temperature		150	150	°C
T_{STG}	Storage Temperature Range		-55 to 150	-55 to 150	°C
I_S	Diode Continuous Forward Current	T_C=25°C	30	-30	
I_{DM}①	Pulse Drain Current Tested	T_C=25°C	51	-35	A
I_D	Continuous Drain Current	T_C=25°C	21	-14	A
		T_C=100°C	13	-9	
P_D	Maximum Power Dissipation	T_C=25°C	33		W
		T_C=100°C	13		
I_D	Continuous Drain Current	T_A=25°C	5.2	-3.4	A
		T_A=70°C	4.1	-2.7	
P_D	Maximum Power Dissipation	T_A=25°C	2.1		W
		T_A=70°C	1.3		
I_{AS}②	Avalanche Current, Single pulse	L=0.1mH	19	-18	A
		L=0.5mH	9	-8.5	
E_{AS}②	Avalanche Energy, Single pulse	L=0.1mH	18	16	mJ
		L=0.5mH	20	18	

Thermal Characteristics

Symbol	Parameter		Rating	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	Steady State	3.8	°C/W
$R_{\theta JA}$③	Thermal Resistance-Junction to Ambient	Steady State	60	°C/W

Note ①：Max. current is limited by bonding wire.
Note ②：UIS tested and pulse width are limited by maximum junction temperature 150°C
Note ③：Surface Mounted on 1in^2 FR-4 board with 1oz.

N-Channel Electrical Characteristics (T_J=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Electrical Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_{DS}=250uA	60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=48V, V_{GS}=0V	-	-	1	uA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250uA	1	1.8	2.5	V
I_{GSS}	Gate Leakage Current	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
$R_{DS(ON)}$④	Drain-Source On-state Resistance	V_{GS}=10V, I_{DS}=10A	-	31.5	38	mΩ
		V_{GS}=4.5V, I_{DS}=5A	-	33.5	44	
gfs	Forward Transconductance	V_{DS}=5V, I_{DS}=10A	-	17.2	-	S
Dynamic Characteristics ⑤						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V, Freq.=1MHz	-	3.8	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=30V, Freq.=1MHz	-	1147	-	pF
C_{oss}	Output Capacitance		-	52	-	
C_{rss}	Reverse Transfer Capacitance		-	40	-	
$td_{(ON)}$	Turn-on Delay Time	V_{GS}=10V,V_{DS}=30V, I_D=1A,R_{GEN}=3Ω	-	6.9	-	nS
t_r	Turn-on Rise Time		-	3.5	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	32.7	-	
t_f	Turn-off Fall Time		-	18.1	-	
Q_g	Total Gate Charge	V_{GS}=4.5V,V_{DS}=30V I_D=10A	-	12.3	-	nC
Q_g	Total Gate Charge	V_{GS}=10V,V_{DS}=30V, I_D=10A	-	26	-	
Q_{gs}	Gate-Source Charge		-	6.25	-	
Q_{gd}	Gate-Drain Charge		-	3.67	-	
Source-Drain Characteristics						
V_{SD}④	Diode Forward Voltage	I_{SD}=1A, V_{GS}=0V	-	0.75	1.1	V
t_{rr}	Reverse Recovery Time	I_F=1A, V_R=10 dI$_F$/dt=100A/μs	-	14	-	nS
Q_{rr}	Reverse Recovery Charge		-	9	-	nC

Note ④ : Pulse test (pulse width≤300us, duty cycle≤2%).
Note ⑤ : Guaranteed by design, not subject to production testing.

N-Channel Typical Characteristics

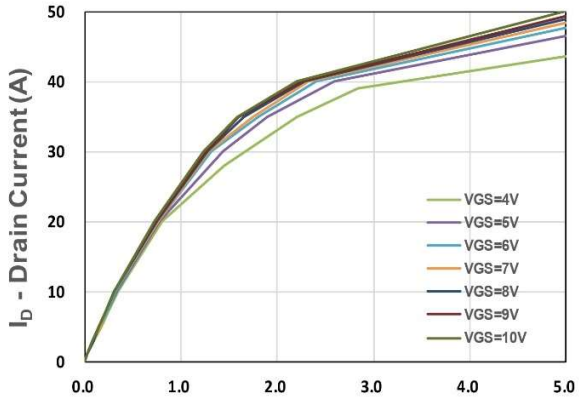


Figure 1. Output Characteristics

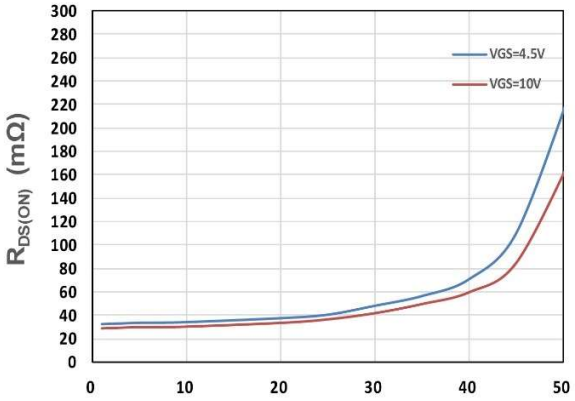


Figure 2. On-Resistance vs. ID

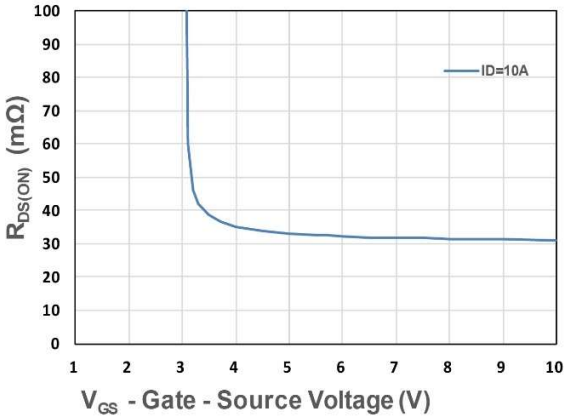


Figure 3. On-Resistance vs. VGS

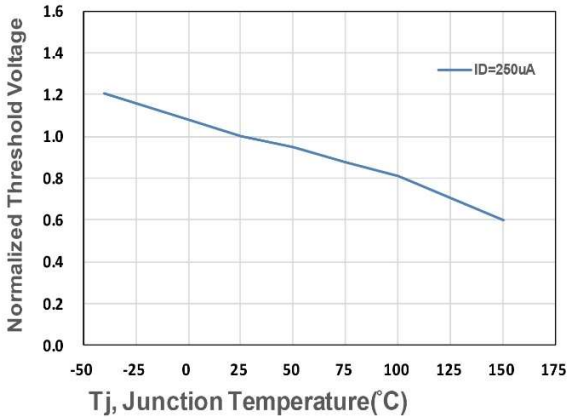


Figure 4. Gate Threshold Voltage

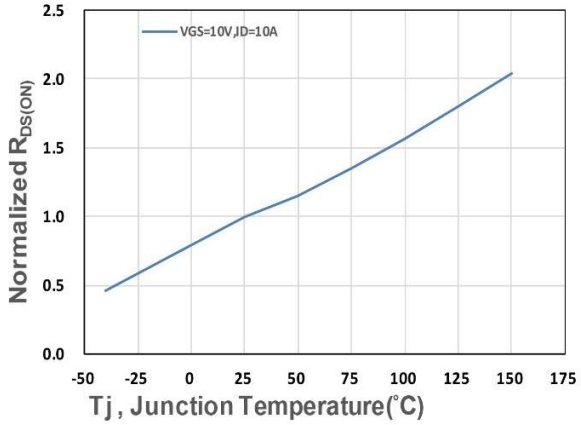


Figure 5. Drain-Source On Resistance

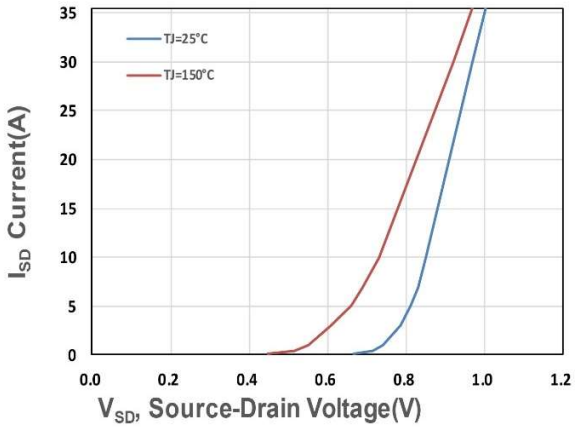


Figure 6. Source-Drain Diode Forward

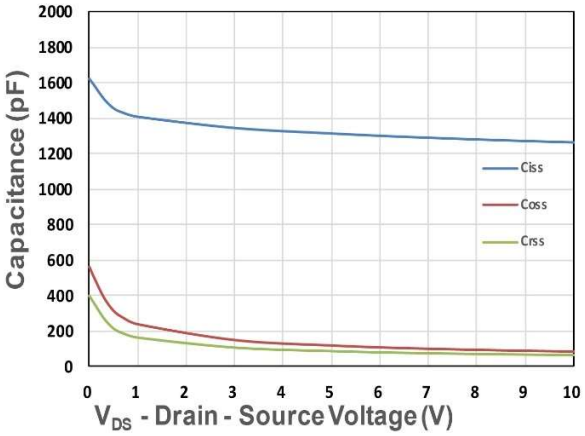


Figure 7. Capacitance

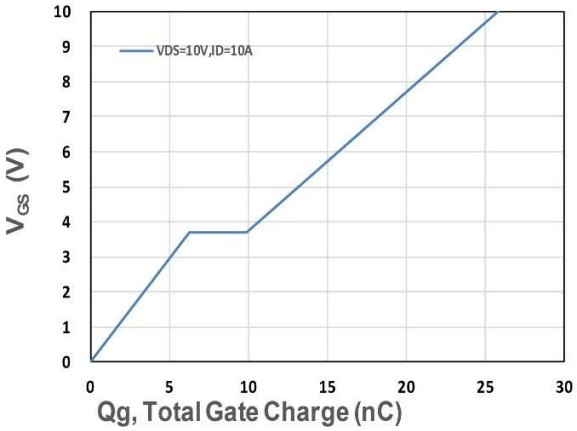


Figure 8. Gate Charge Characteristics

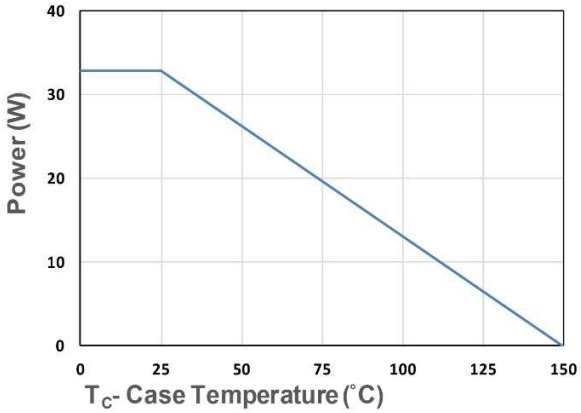


Figure 9. Power Dissipation

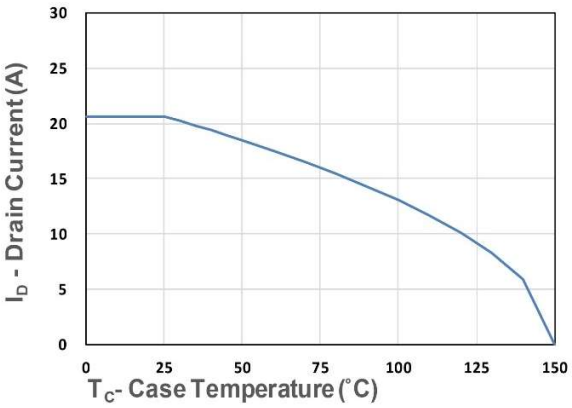


Figure 10. Drain Current

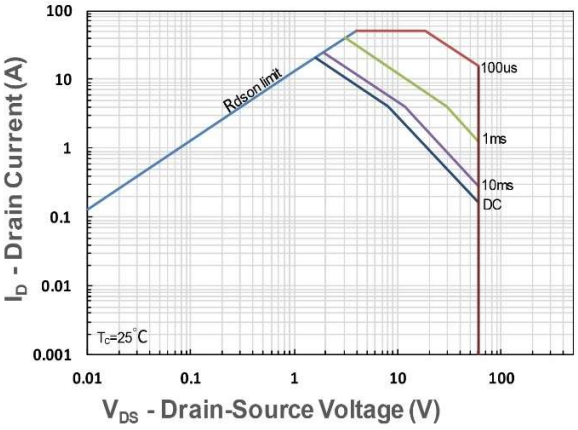


Figure 11. Safe Operating Area

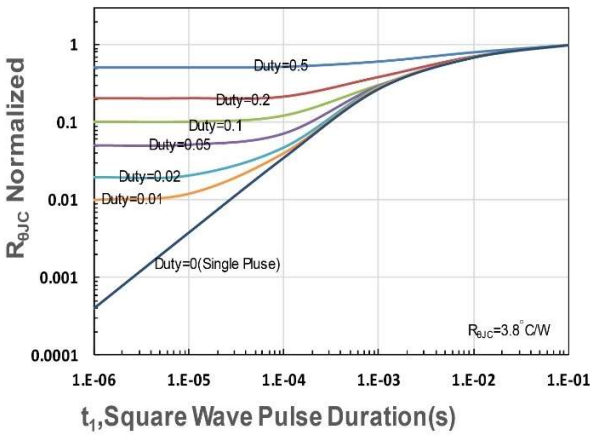


Figure 12. RθJC Transient Thermal Impedance

P-Channel Electrical Characteristics (T_J=25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Electrical Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_{DS}=-250uA	-60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=-48V, V_{GS}=0V	-	-	-1	uA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=-250uA	-1	-1.8	-2.5	V
I_{GSS}	Gate Leakage Current	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA
$R_{DS(ON)}$④	Drain-Source On-state Resistance	V_{GS}=-10V, I_{DS}=-10A	-	74	89	mΩ
		V_{GS}=-4.5V, I_{DS}=-5A	-	78	101	
gfs	Forward Transconductance	V_{DS}=-5V, I_{DS}=-10A	-	15.4	-	S
Dynamic Characteristics ⑤						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V, Freq.=1MHz	-	10.8	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=-30V, Freq.=1MHz	-	1303	-	pF
C_{oss}	Output Capacitance		-	54	-	
C_{rss}	Reverse Transfer Capacitance		-	40	-	
$td_{(ON)}$	Turn-on Delay Time	V_{GS}=-10V,V_{DS}=-30V, I_D=-1A,R_{GEN}=3Ω	-	6.9	-	nS
t_r	Turn-on Rise Time		-	3.7	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	70.6	-	
t_f	Turn-off Fall Time		-	31.3	-	
Q_g	Total Gate Charge	V_{GS}=-4.5V,V_{DS}=-30V I_D=-6A	-	12.6	-	nC
Q_g	Total Gate Charge	V_{GS}=-10V,V_{DS}=-30V, I_D=-6A	-	27	-	
Qgs	Gate-Source Charge		-	6.6	-	
Qgd	Gate-Drain Charge		-	3.26	-	
Source-Drain Characteristics						
V_{SD}④	Diode Forward Voltage	I_{SD}=-1A, V_{GS}=0V	-	-0.75	-1.1	V
t_{rr}	Reverse Recovery Time	I_F=-1A, V_R=0V dI$_F$/dt=100A/μs	-	12	-	nS
Q_{rr}	Reverse Recovery Charge		-	7	-	nC

P-Channel Typical Characteristics

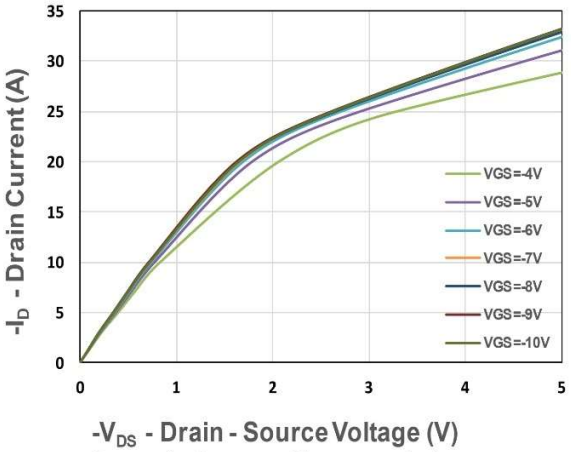


Figure 1. Output Characteristics

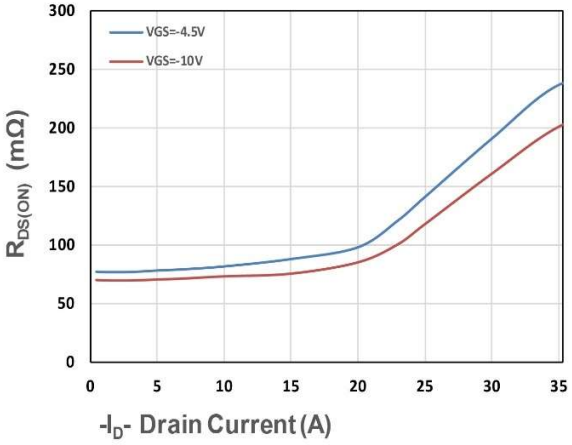


Figure 2. On-Resistance vs. ID

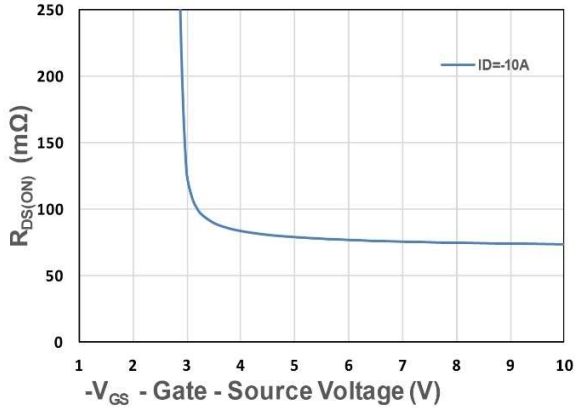


Figure 3. On-Resistance vs. VGS

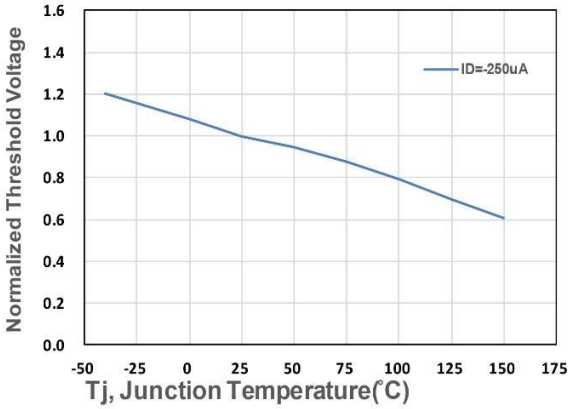


Figure 4. Gate Threshold Voltage

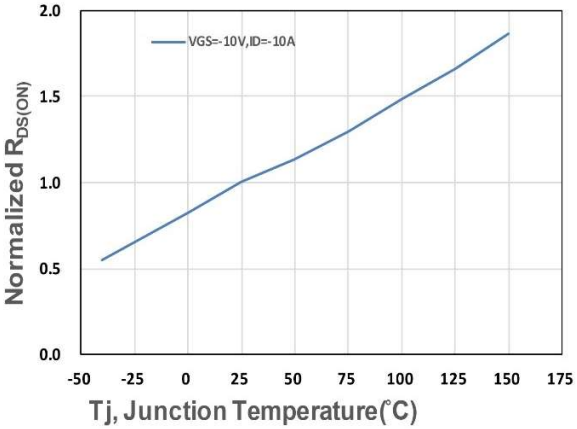


Figure 5. Drain-Source On Resistance

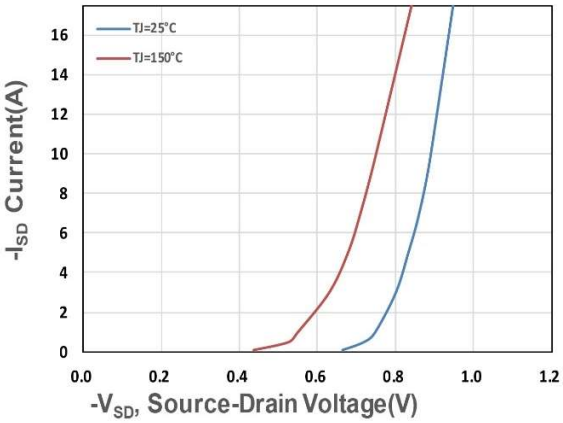


Figure 6. Source-Drain Diode Forward

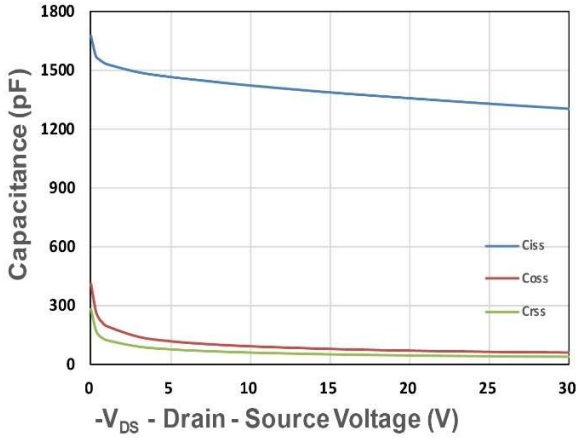


Figure 7. Capacitance

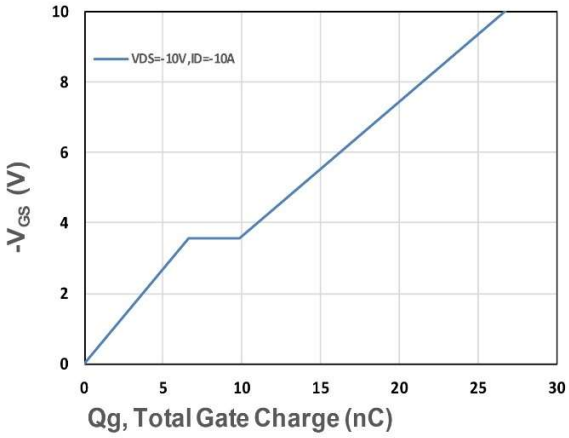


Figure 8. Gate Charge Characteristics

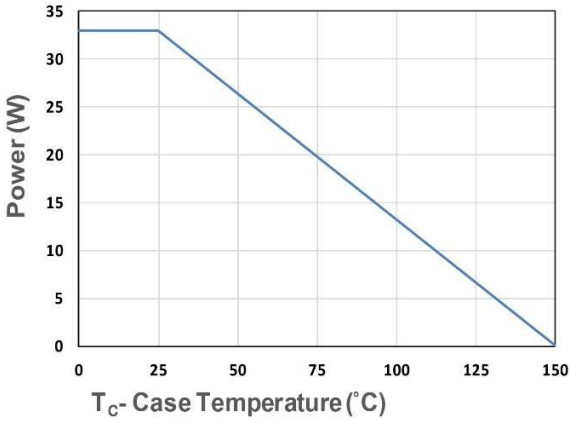


Figure 9. Power Dissipation

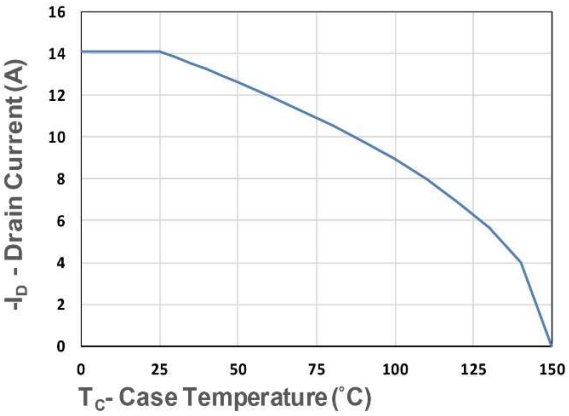


Figure 10. Drain Current

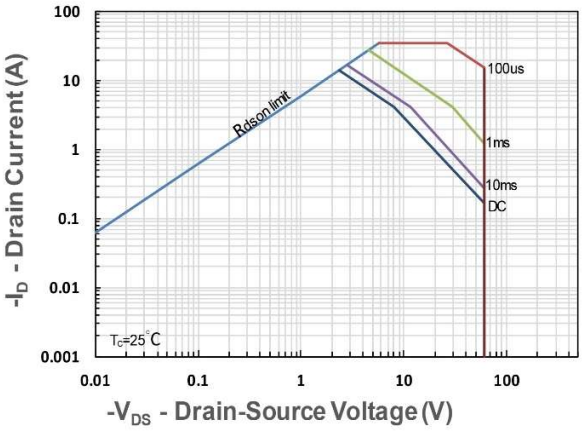


Figure 11. Safe Operating Area

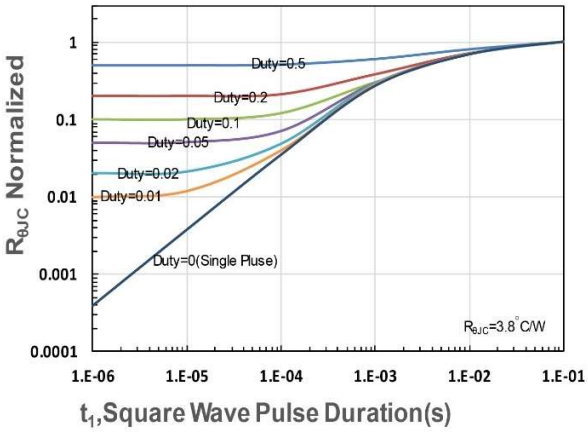


Figure 12. RθJC Transient Thermal Impedance