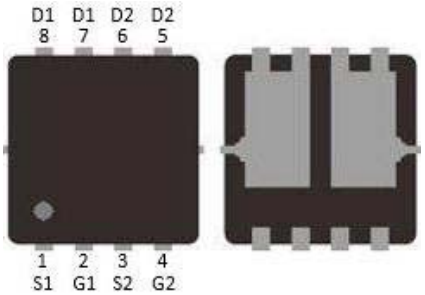
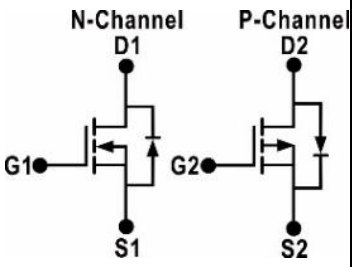
SGD6240ED

60V /-60V Complementary, Power MOSFET

Parameter	N channel	P channel	Unit
V_{DSS}	60	-60	V
$R_{DS\ (ON)}$ typ. VGS=10V	40	79	mΩ
$R_{DS\ (ON)}$ typ. VGS=4.5V	50	106	mΩ
I_D	8	-4.9	A
$Q_{g\ 10V}$	14.3	14.6	nC
Q_{gd}	1.5	2.4	nC
Q_{SW}	3.6	4.3	pF

PDFN3.3x3.3 (Dual A)





Features

- Low On-Resistance
- Low Input Capacitance
- Low Miller Charge
- Low Input / Output Leakage
- Pb-free lead plating; RoHS compliant

Application

- Motor / Body Load Control
- Automotive Systems
- Load Switch

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SGD6240ED	Halogen-Free	PDFN3.3x3.3-8L (Dual A)	ED	Tape & Reel	5,000

Absolute Maximum Ratings (T_J=25°C unless otherwise noted)

Parameter		Symbol	N channel	P channel	Unit
Drain-Source Voltage		V_{DS}	60	-60	V
Gate-Source Voltage		V_{GS}	±20	±20	V
Drain Current-Continuous Note 1	T_C=25°C	I_D	8.0	-4.9	A
	T_C=100°C		5.0	-3.1	A
Drain Current-Continuous Note 2	T_A=25°C	I_D	3.6	-2.3	A
	T_A=70°C		2.9	-1.9	A
Drain Current-Pulsed Note 3	T_A=25°C	I_{DM}	25.0	-15.0	A
Avalanche Current		I_{AR}	9.9	-20.7	A
Single Pulse Avalanche Energy Note 4		E_{AS}	4.9	21.4	mJ
Maximum Power Dissipation	T_C=25°C	P_D	4.8	3.8	W
	T_C=100°C		1.9	1.5	W
	T_A=25°C	P_D	1.0	0.9	W
	T_A=70°C		0.6	0.5	W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance, Junction-Case Note 5	$R_{\theta JC}$	Steady State(N-Channel)	-	-	23.5	°C/W
		Steady State(P-Channel)		-	29.2	°C/W
Thermal resistance, Junction-Ambient Note 5	$R_{\theta JA}$	Steady State(N-Channel)		-	109.6	°C/W
		Steady State(P-Channel)	-	-	122.5	°C/W

Notes:

1. Limited by silicon chip capability and $R_{\theta JC}$ junction-to-case thermal resistance.
2. The maximum current rating is limited by package and $R_{\theta JA}$ junction-to-ambient thermal resistance.
3. Must be ensure junction temperature does not exceed 175-degree C.

4. Limited by TJmax, starting TJ = 25°C, L = 0.1mH, Rg = 25Ω, VGS = 10V.
5. The value of thermal resistance is measured with the single device put on cooling plate under a still air environment temperature is 25 degree C based on JEDEC standard JESD51-14 and JESD51-2a. Thermal resistance obtained depends on the user's specific board design and given application.

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

STATIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_{DS}=250μA	60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=60V, V_{GS}=0V	-	-	1	μA
		V_{DS}=60V, V_{GS}=0V, T_J=125°C	-	-	100	μA
Gate-Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA

STATIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_{DS}=250μA	1.3	1.7	2.1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_{DS}=8A	-	35	40	mΩ
		V_{GS}=4.5V, I_{DS}=4A	-	44.3	50	mΩ
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	-	1.2	-	Ω
Forward Transconductance	g_{fs}	V_{DS}=5V, I_{DS}=4A	-	4.4	-	S

DYNAMIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Capacitance	C_{iss}	V_{DD}=60V,V_{DS}=30V, V_{GS}=0V, f=1MHz	-	899.3	-	pF
Output Capacitance	C_{oss}	V_{DD}=60V,V_{DS}=30V, V_{GS}=0V, f=1MHz	-	43.4	-	pF
Reverse Transfer Capacitance	C_{rss}	V_{DD}=60V,V_{DS}=30V, V_{GS}=0V, f=1MHz	-	27.1	-	pF
Turn-On Delay Time	$T_{d(on)}$	V_{DS}=30V, V_{GS}=10V, I_{DS}=6A, R_{GEN}=3Ω	-	6.2	-	nS
Rise Time	t_r	V_{DS}=30V, V_{GS}=10V, I_{DS}=6A, R_{GEN}=3Ω	-	7.4	-	nS
Turn-Off Delay Time	$T_{d(off)}$	V_{DS}=30V, V_{GS}=10V, I_{DS}=6A, R_{GEN}=3Ω	-	14.2	-	nS
Fall Time	t_f	V_{DS}=30V, V_{GS}=10V, I_{DS}=6A, R_{GEN}=3Ω	-	1.9	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate to Source Gate Charge	Q_{gs}	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	3.9	-	nC
Gate charge at threshold	$Q_{g(th)}$	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	1.7	-	nC
Gate to Drain Charge	Q_{gd}	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	1.5	-	nC
Switching charge	Q_{SW}	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	3.6	-	nC
Gate charge total	$Q_{g\ 10V}$	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	14.3	-	nC
	$Q_{g\ 4.5V}$	V_{DD}=30V, I_D=6A, V_{GS}=0 to 4.5V	-	6.4	-	nC
Gate plateau voltage	$V_{plateau}$	V_{DD}=30V, I_D=6A, V_{GS}=0 to 10V	-	3.6	-	V
Gate charge total, sync. FET (Q_g- Q_{gd})	$Q_{g(sync)}$	V_{DS}=0.1V, V_{GS}=0 to 10V	-	12.8	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Body Diode continuous forward current	I_S	T_C=25°C	-	-	8	A
Body Diode pulse current	I_{SM}	T_C=25°C	-	-	25	A
Body Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=6A	-	0.84	1.1	V
Body Diode Reverse Recovery Time	t_{rr}	V_{DD}=30V, I_F=6A, di/dt=100A/μs	-	9.9	-	nS
		V_{DD}=30V, I_F=6A, di/dt=200A/μs	-	9.5		nS
Body Diode Reverse Recovery Charge	Q_{rr}	V_{DD}=30V, I_F=6A, di/dt=100A/μs	-	5.3	-	nC
		V_{DD}=30V, I_F=6A, di/dt=200A/μs	-	10.1	-	nC

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

STATIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_{DS}=-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-60V, V_{GS}=0V	-	-	-1	μA
		V_{DS}=-60V, V_{GS}=0V, T_J=125°C	-	-	-100	μA
Gate-Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA

STATIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_{DS}=-250μA	-1.5	-1.7	-2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_{DS}=-4A	-	70.1	79	mΩ
		V_{GS}=-4.5V, I_{DS}=-2A	-	92.9	106	mΩ
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	-	14.8	-	Ω
Forward Transconductance	g_{fs}	V_{DS}=-5V, I_{DS}=-4A	-	4.2	-	S

DYNAMIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Capacitance	C_{iss}	V_{DD}=-60V, V_{DS}=-30V, V_{GS}=0V, f=1MHz	-	806.6	-	pF
Output Capacitance	C_{oss}	V_{DD}=-60V, V_{DS}=-30V, V_{GS}=0V, f=1MHz	-	52.2	-	pF
Reverse Transfer Capacitance	C_{rss}	V_{DD}=-60V, V_{DS}=-30V, V_{GS}=0V, f=1MHz	-	39.4		pF
Turn-On Delay Time	$T_{d(on)}$	V_{DS}=-30V, V_{GS}=-10V, I_{DS}=-4A, R_{GEN}=3Ω	-	6	-	nS
Rise Time	t_r	V_{DS}=-30V, V_{GS}=-10V, I_{DS}=-4A, R_{GEN}=3Ω	-	8.3	-	nS
Turn-Off Delay Time	$T_{d(off)}$	V_{DS}=-30V, V_{GS}=-10V, I_{DS}=-4A, R_{GEN}=3Ω	-	36.1	-	nS
Fall Time	t_f	V_{DS}=-30V, V_{GS}=-10V, I_{DS}=-4A, R_{GEN}=3Ω	-	21.4	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate to Source Gate Charge	Q_{gs}	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	3.4	-	nC
Gate charge at threshold	$Q_{g(th)}$	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	1.5	-	nC
Gate to Drain Charge	Q_{gd}	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	2.4	-	nC
Switching charge	Q_{SW}	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	4.3	-	nC
Gate charge total	$Q_{g\ 10V}$	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	14.6	-	nC
	$Q_{g\ 4.5V}$	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -4.5V	-	6.8	-	nC
Gate plateau voltage	$V_{plateau}$	V_{DD}=-30V, I_D=-4A, V_{GS}=0 to -10V	-	3.6	-	V
Gate charge total, sync. FET (Q_g- Q_{gd})	$Q_{g(sync)}$	V_{DS}=0.1V, V_{GS}=0 to -10V	-	12.1	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Body Diode continuous forward current	I_S	T_C=25°C	-	-	-4.9	A
Body Diode pulse current	I_{SM}	T_C=25°C	-	-	-15	A
Body Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=-4A	-	-0.87	-1.1	V
Body Diode Reverse Recovery Time	t_{rr}	V_{DD}=-30V, I_F=-4A, di/dt=100A/μs	-	12	-	nS
		V_{DD}=-30V, I_F=-4A, di/dt=200A/μs		11.8		nS
Body Diode Reverse Recovery Charge	Q_{rr}	V_{DD}=-30V, I_F=-4A, di/dt=100A/μs		7.3		nC
		V_{DD}=-30V, I_F=-4A, di/dt=200A/μs	-	12.9	-	nC

N-Channel Typical Operating Characteristics

Fig. 1 Output Characteristics

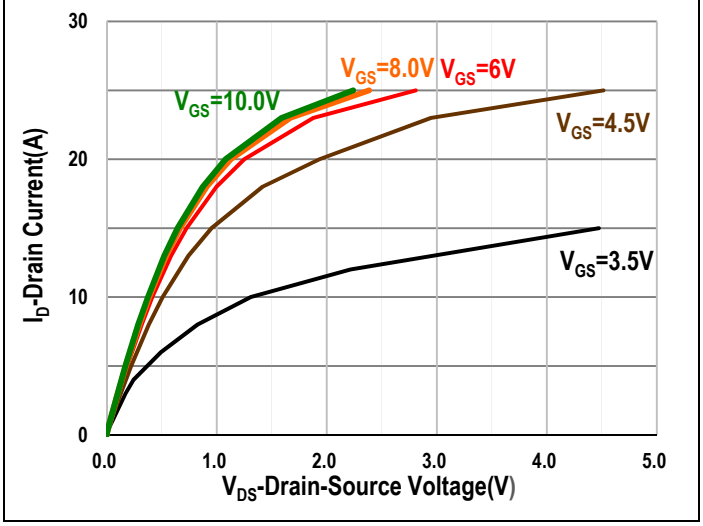


Fig. 2 Gate Threshold Voltage Vs Ta

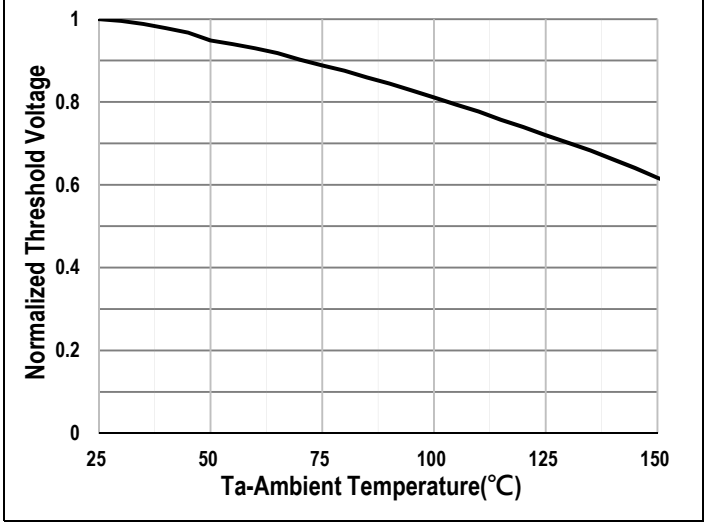


Fig. 3 Drain-Source On Resistance

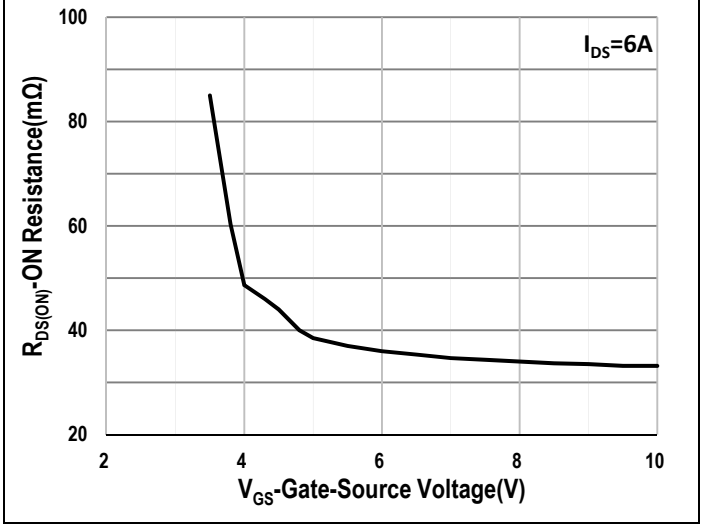


Fig. 4 Normalized On Resistance Vs T_a

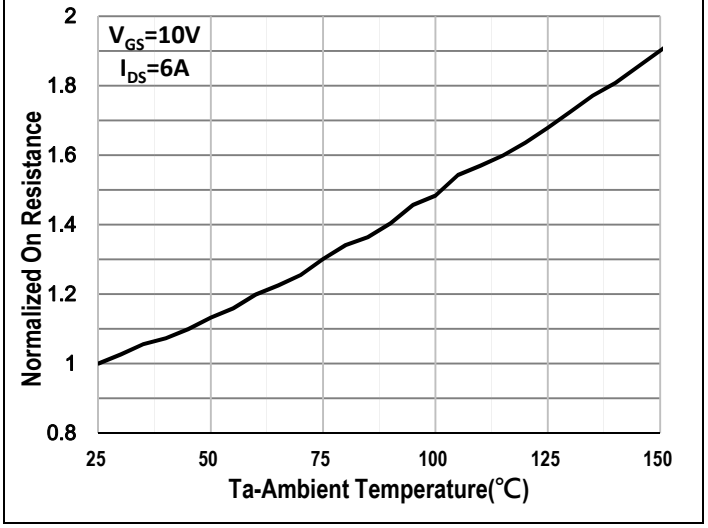


Fig. 5 Drain-Source On Resistance

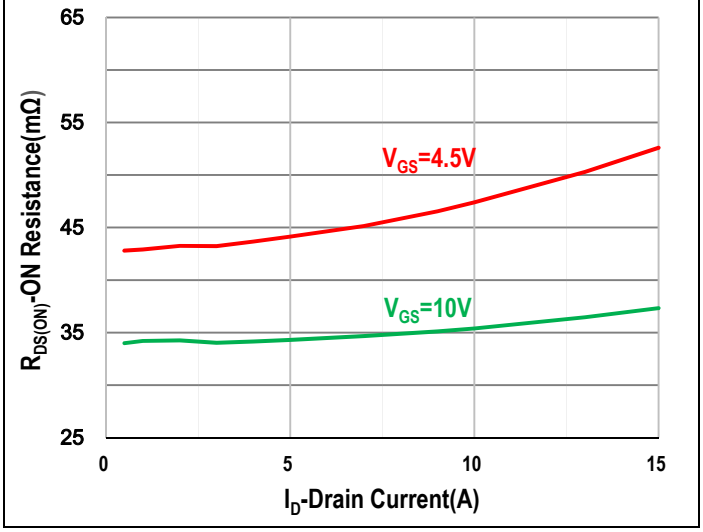
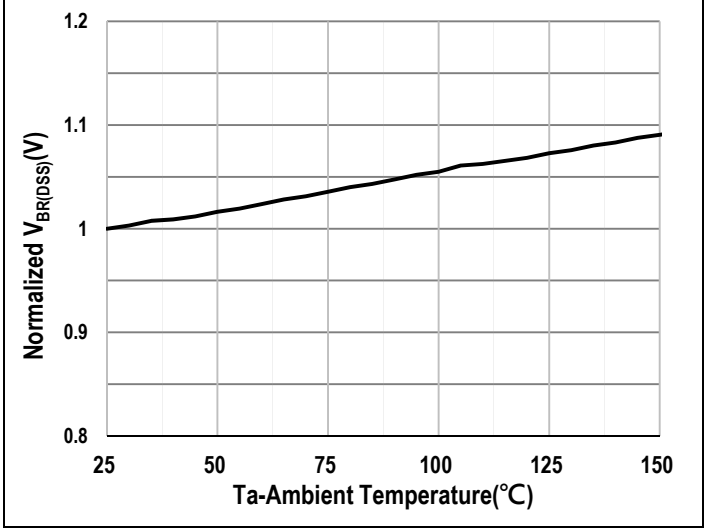


Fig. 6 Drain-source Breakdown Voltage Vs T_a



N-Channel Typical Operating Characteristics

Fig. 7 Capacitance Vs V_{DS}

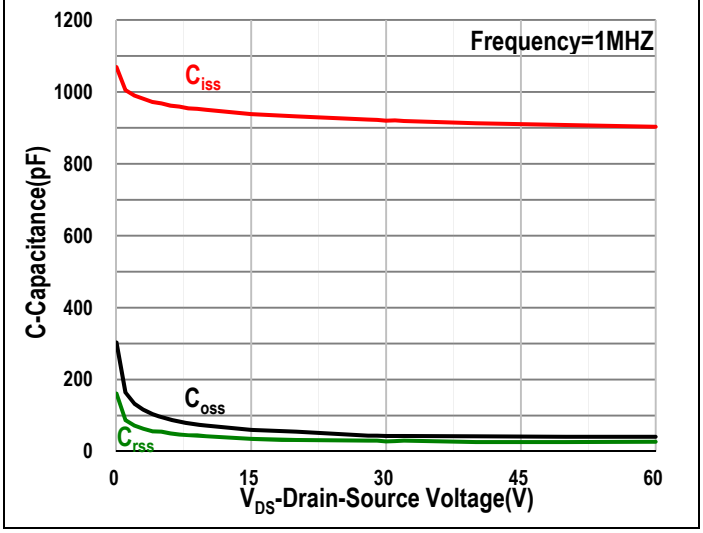


Fig. 8 Gate Charge Vs V_{GS}

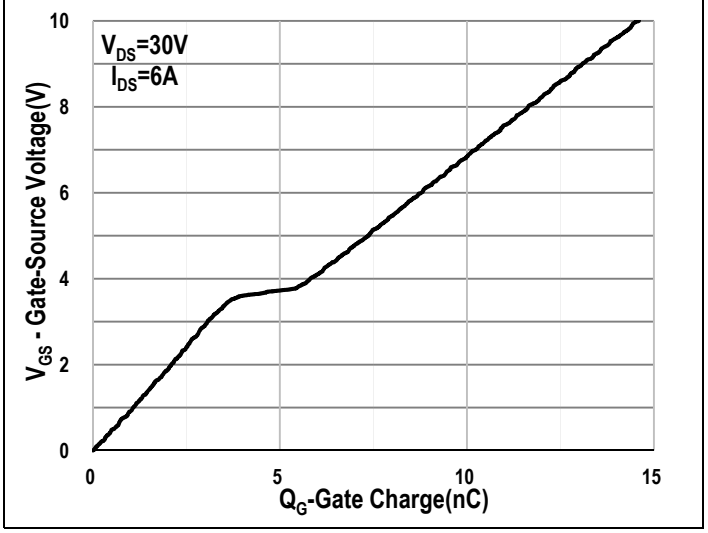


Fig.9 Power Dissipation Vs Tc

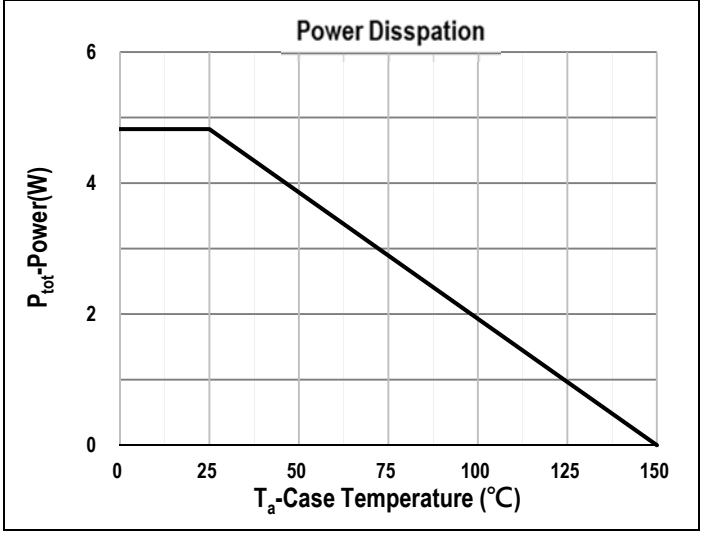


Fig.10 Drain Current Vs Tc

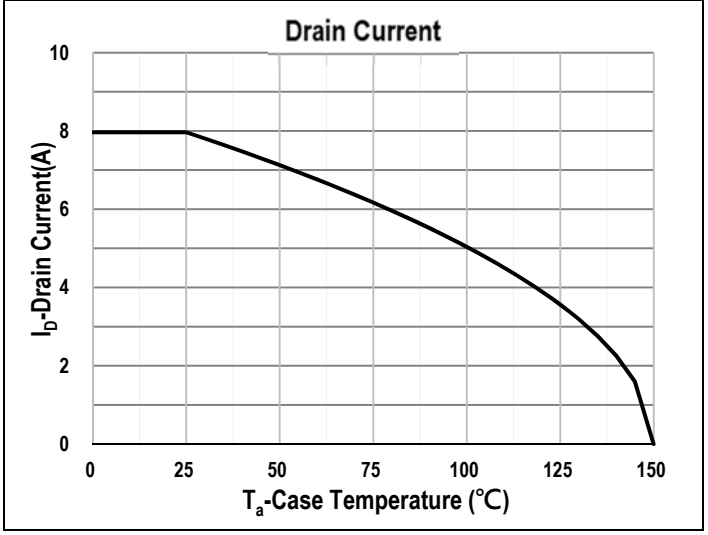


Fig. 11 Body Diode Forward Voltage Vs I_{SD}

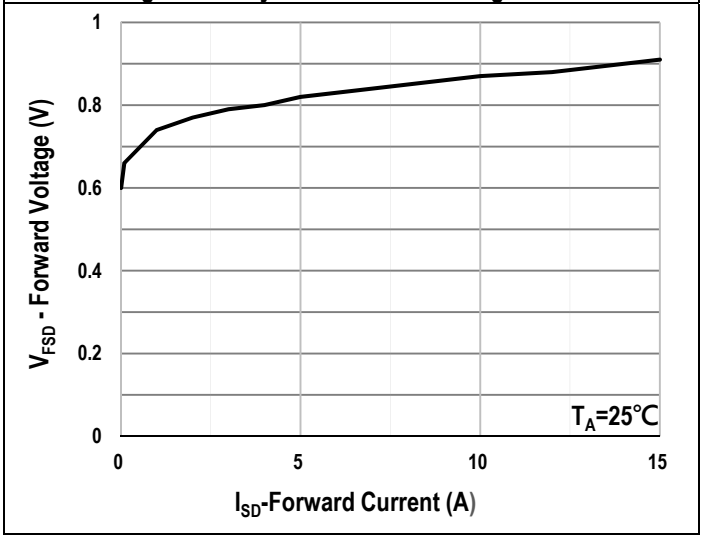


Fig. 12 Body Diode Forward Voltage Vs T_A

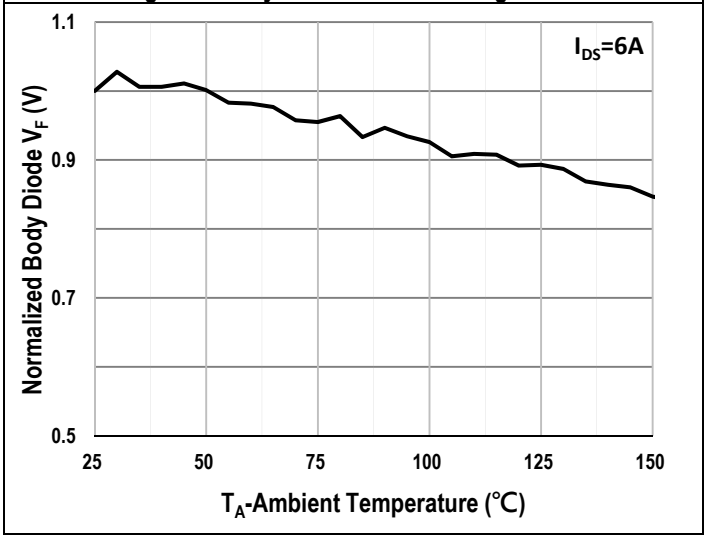


Fig. 13 Safe Operation Area

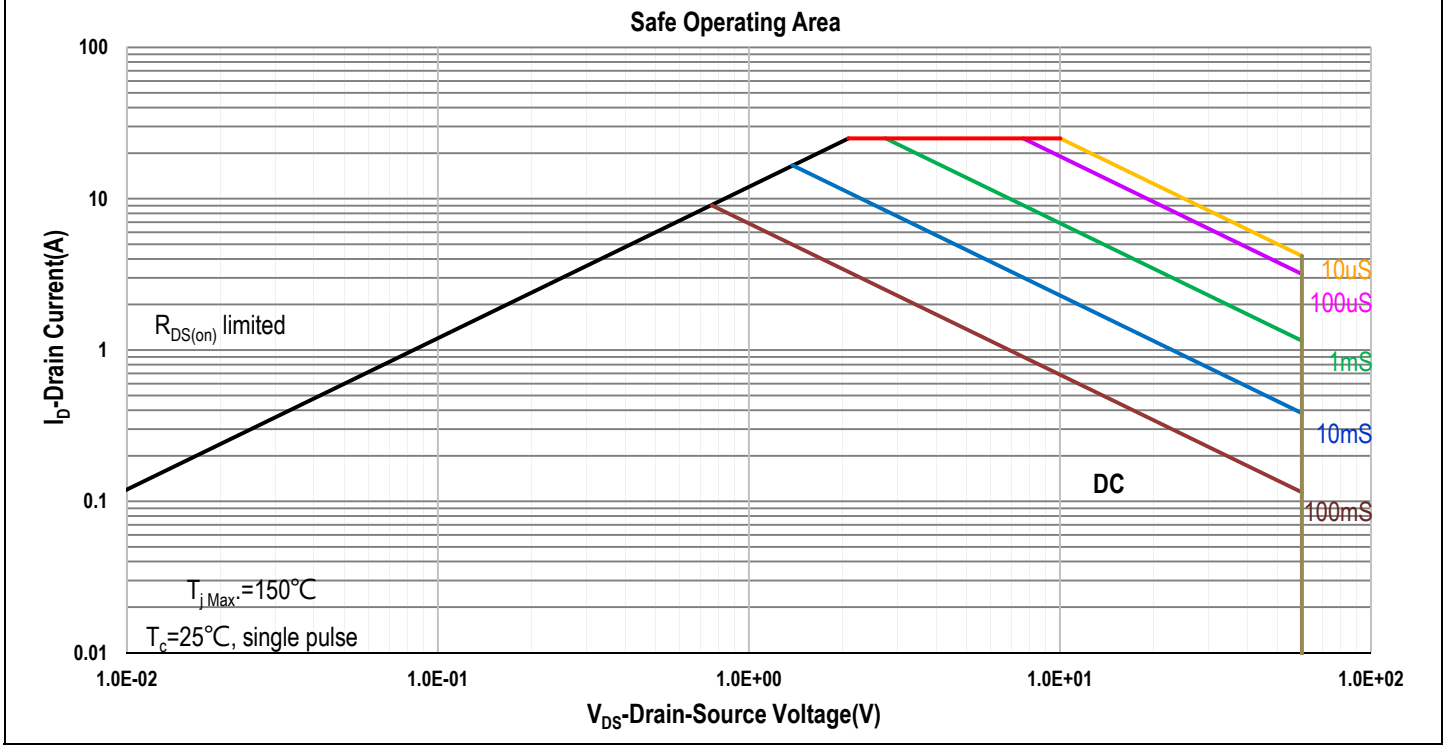
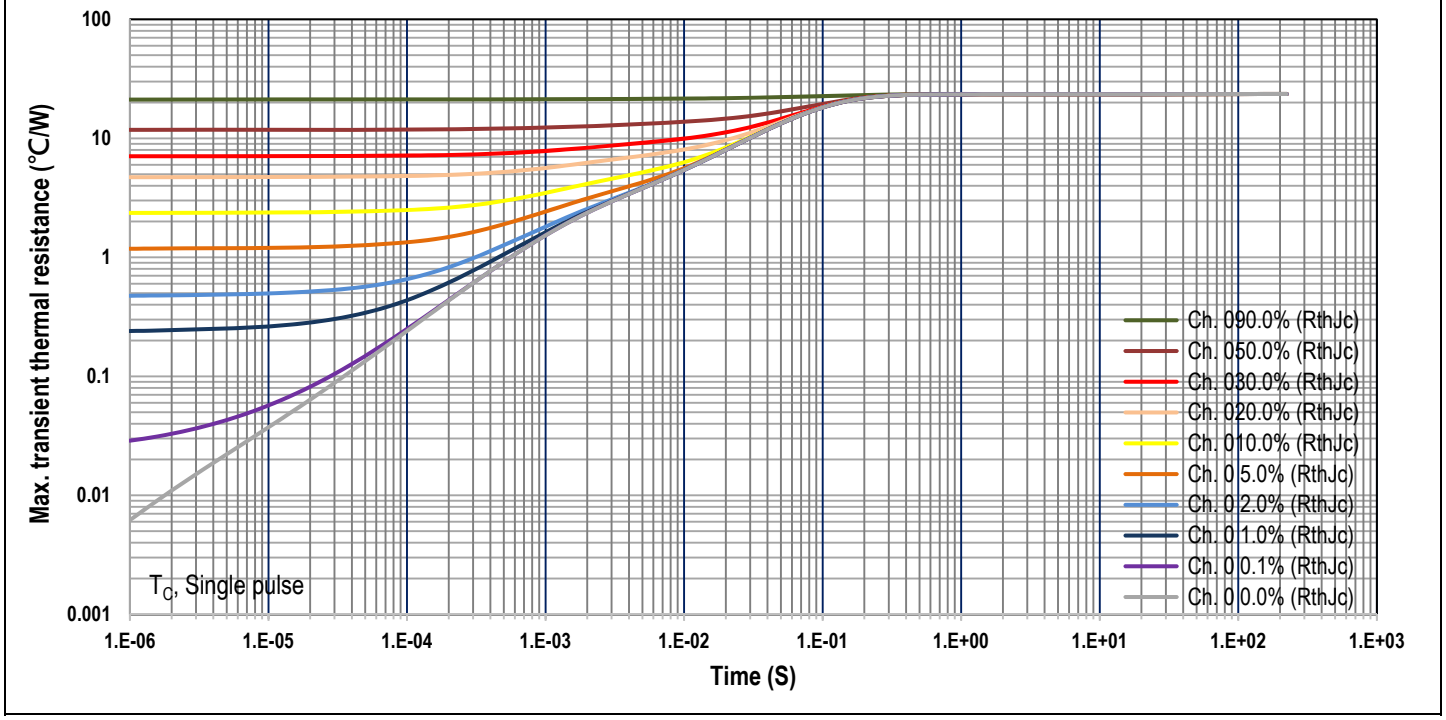


Fig. 14 Transient Thermal Impedance



P-Channel Typical Operating Characteristics

Fig. 15 Output Characteristics

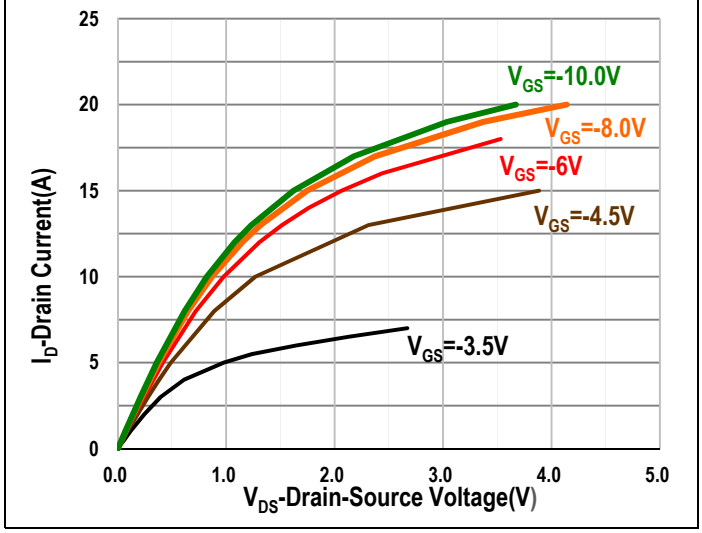


Fig. 16 Gate Threshold Voltage Vs T_a

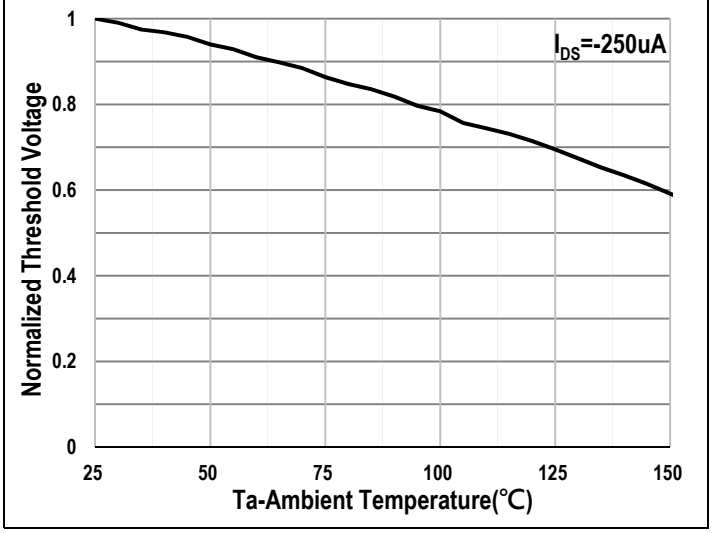


Fig. 17 Drain-Source On Resistance

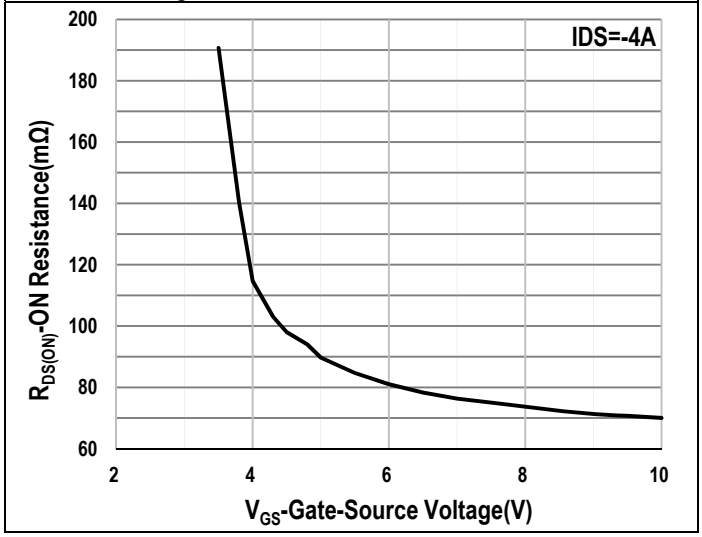


Fig. 18 Normalized On Resistance Vs T_a

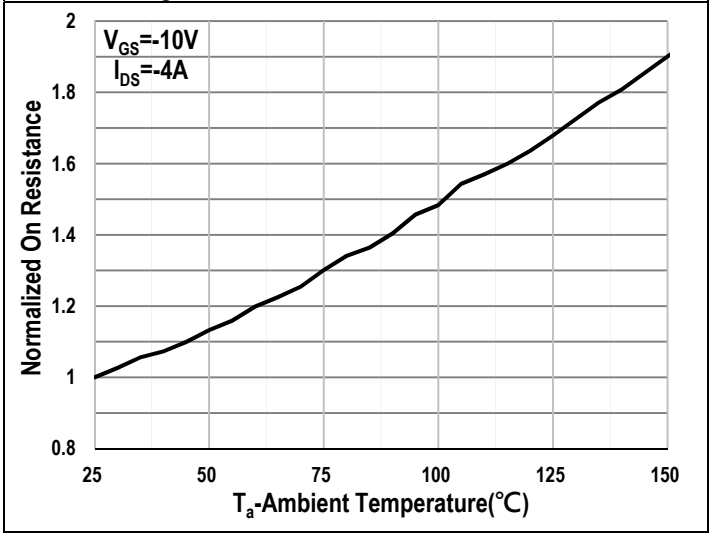


Fig. 19 Drain-Source On Resistance

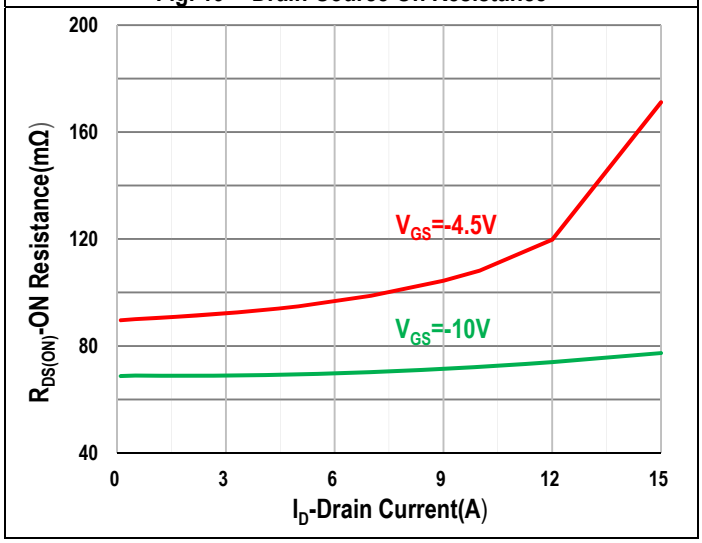
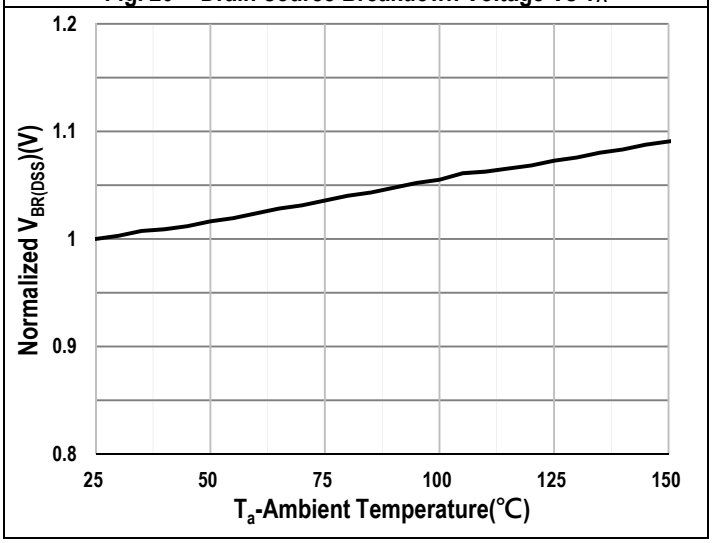


Fig. 20 Drain-source Breakdown Voltage Vs T_A



P-Channel Typical Operating Characteristics

Fig. 21 Capacitance Vs V_{DS}

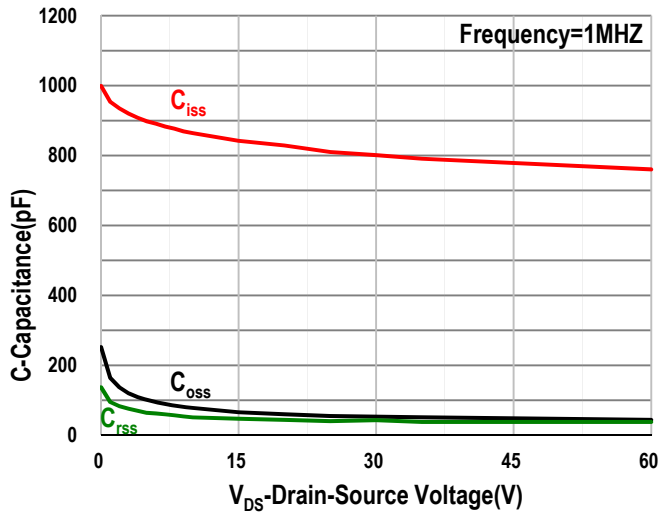


Fig. 22 Gate Charge Vs V_{GS}

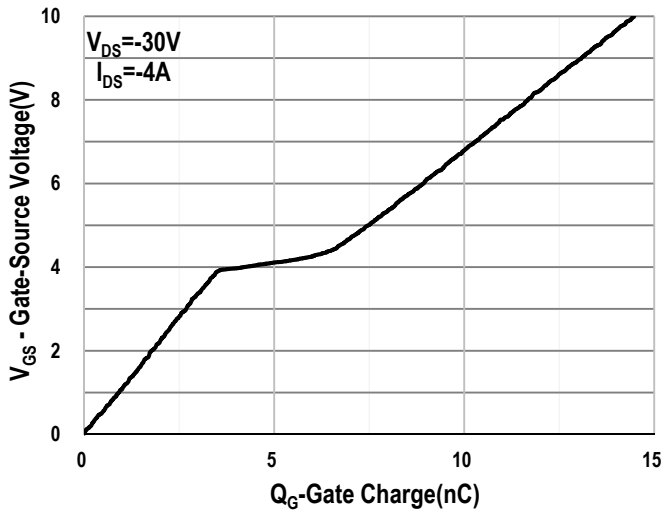


Fig. 23 Power Dissipation Vs Tc

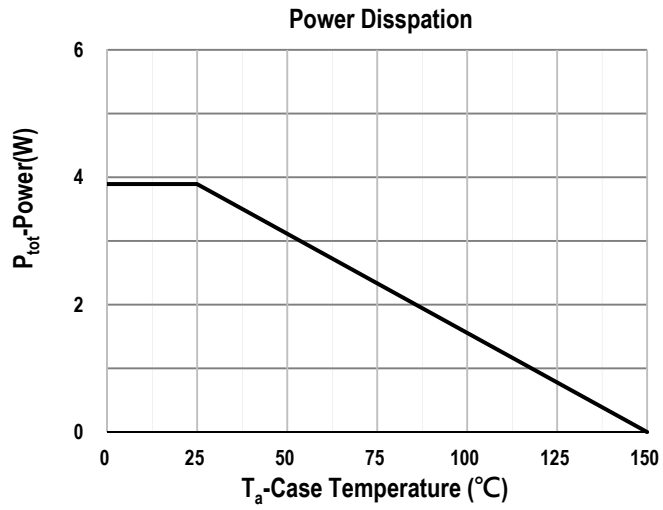


Fig. 24 Drain Current Vs Tc

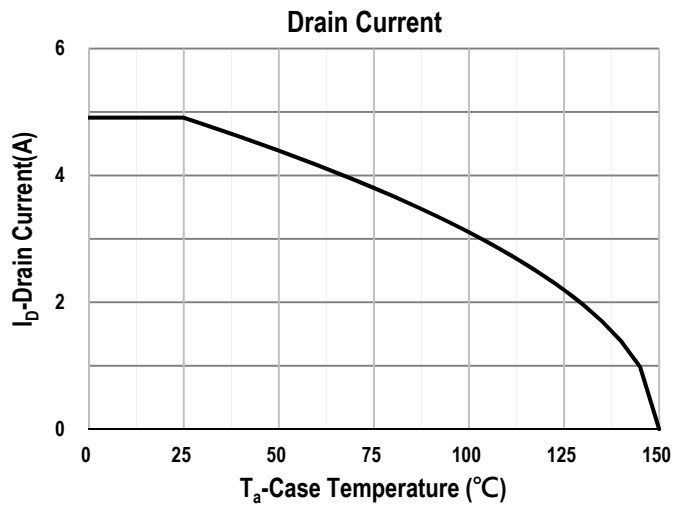


Fig. 25 Body Diode Forward Voltage Vs I_{SD}

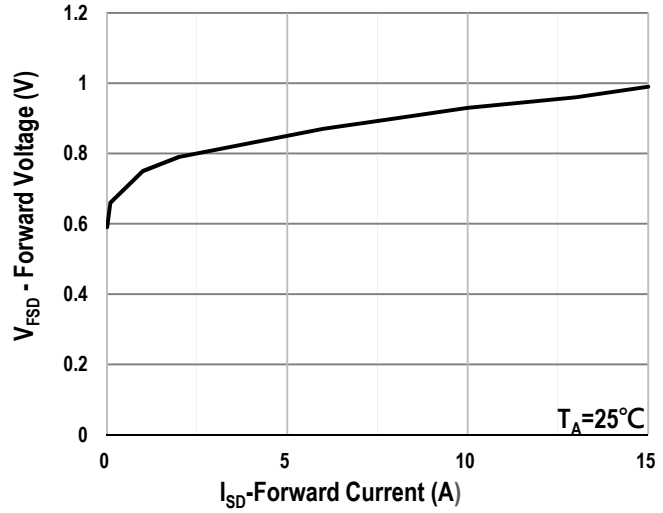


Fig. 26 Body Diode Forward Voltage Vs T_A

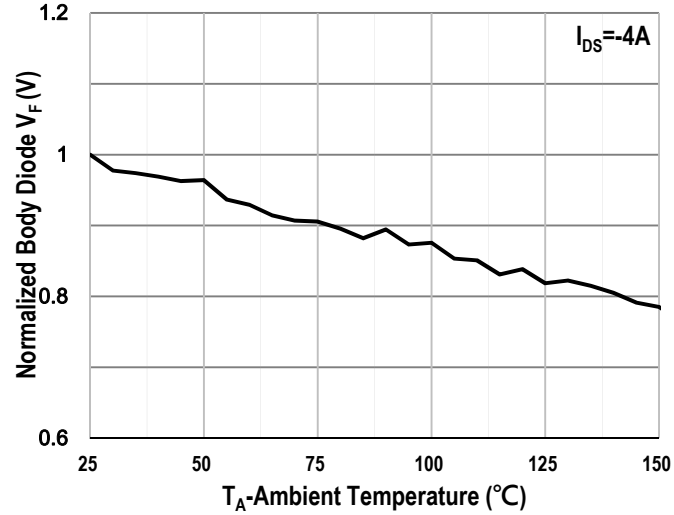


Fig.27 Safe Operation Area

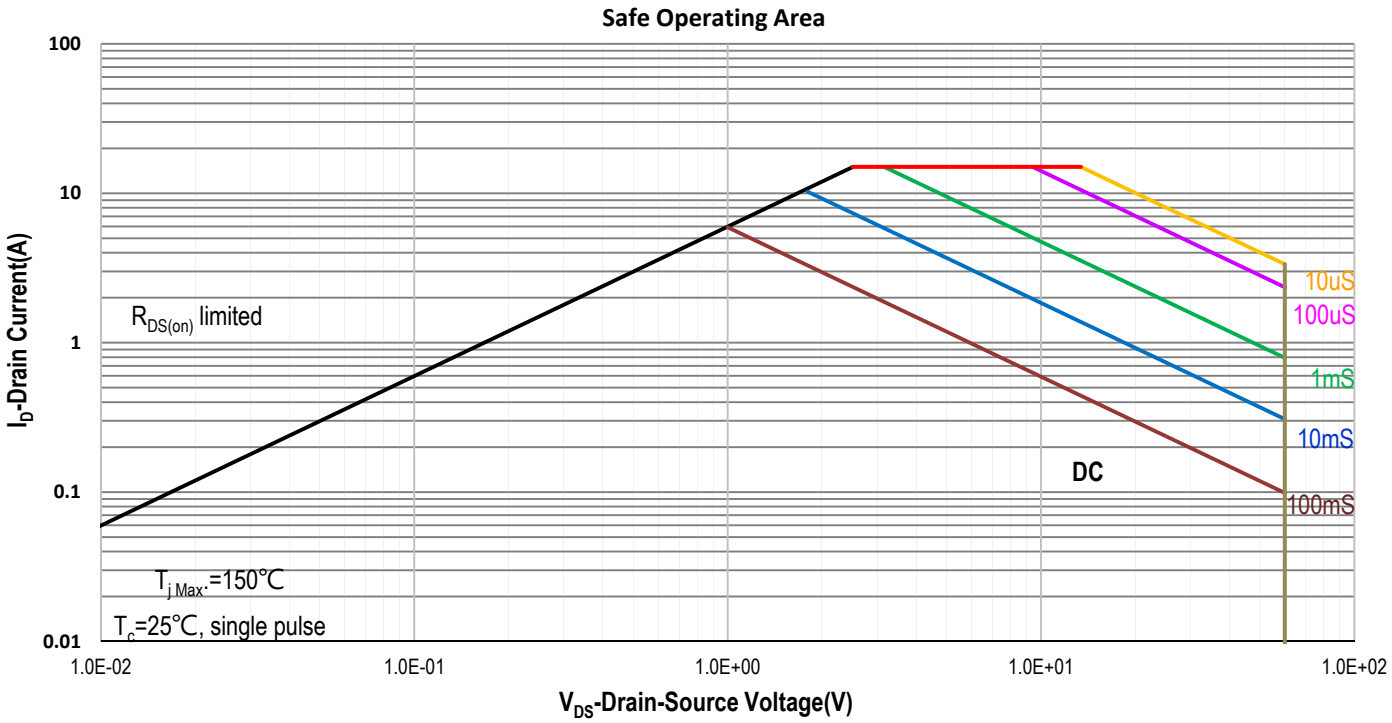
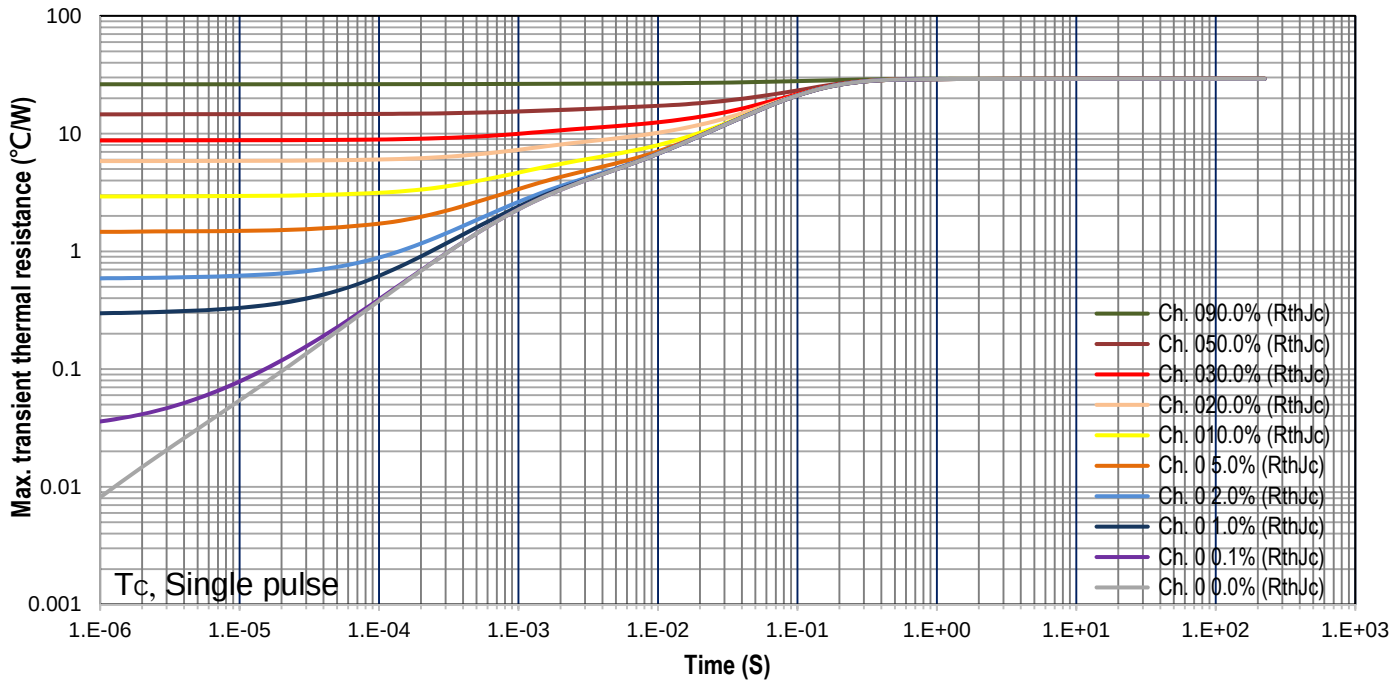
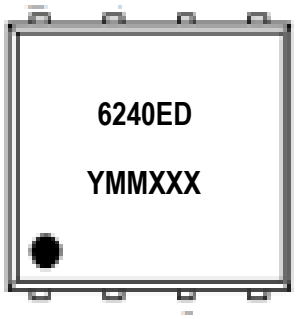


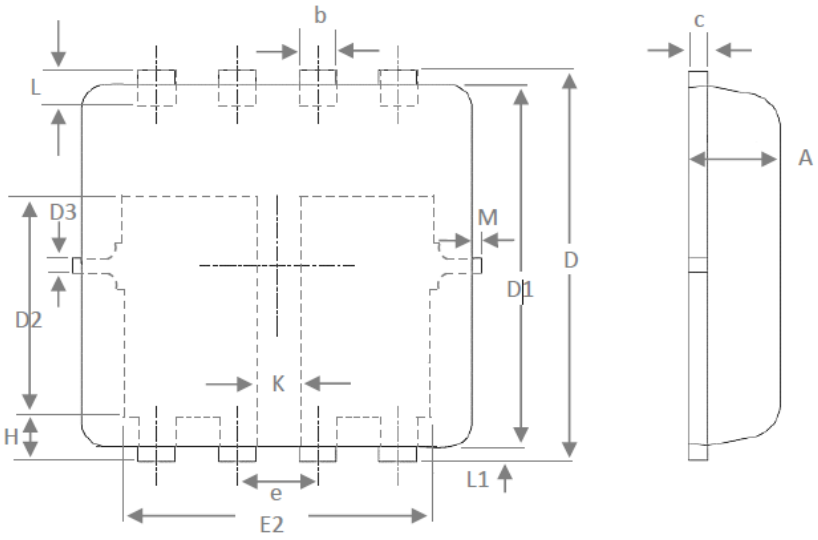
Fig.28 Transient Thermal Impedance

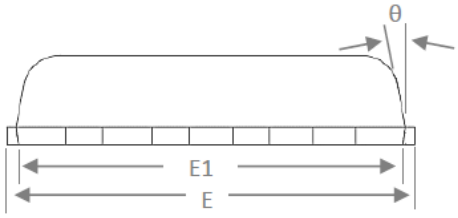


Marking Information

PDFN 3.3x3.3-8L (E/ED)	Marking Rule
Laser Marking  	Line 1：Device 6240ED Line 2：Date Code YMMXXX Y：Year Code MM：Month Code XXX：Serial Number

Package of dimension



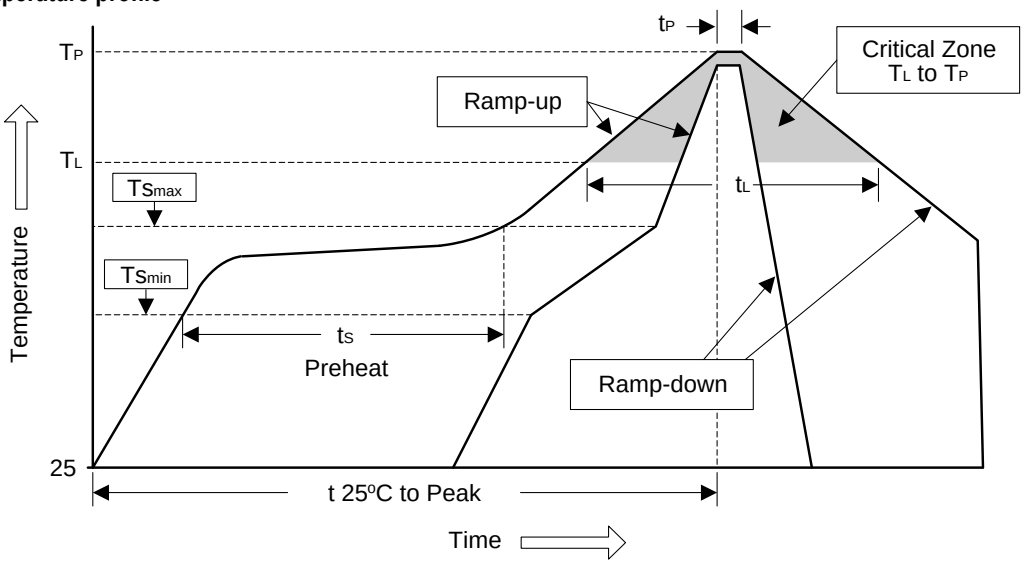


Symbol	Min	Nor	Max
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.78	1.88	1.98
D3	-	0.13	-
E	3.00	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e	0.65BSC		
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
K	0.30	-	-
θ	-	10°	12°
M	-	-	0.15

Soldering Methods for Silicongear's Products

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60 to 120 sec	 150°C 200°C 60 to 180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60 to 150 sec	 217°C 60 to 150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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