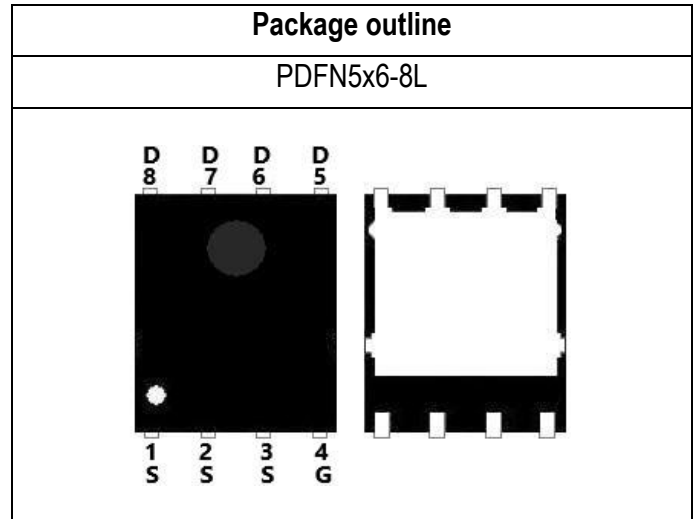


Key parameter	Value	Unit
$V_{(BR)DSS}$ min.	60	V
$R_{DS(ON)}$ max. $V_{GS}=10V$	4.8	m Ω
$R_{DS(ON)}$ max. $V_{GS}=4.5V$	6.3	m Ω
$V_{GS(TH)}$ Typ.	1.5	V
I_D	99	A
Q_g 10V Typ.	52.8	nC
C_{iss} Typ.	2667	pF
E_{AS}	31.2	mJ



Description

These devices used double-gate structure of MOSFET to provide excellent electrical parameter. There is high speed switching capacity, low $R_{DS(ON)}$ resistance, low gate charge and stable characteristics for these devices. Moreover, it is a helpful choose for raise efficiency or reduce consumption in circuit. These features combine to be an advantage design for use in wide variety of application including converter and inverter design.

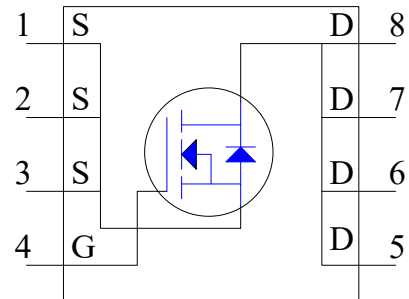
Features

- ◇ Fast switch capacity
- ◇ Low $R_{DS(ON)}$ resistance
- ◇ Low input capacitance
- ◇ Low Switching Loss
- ◇ Ruggedness commutation capability
- ◇ Pb-free lead plating; RoHS compliant

Potential application

- AC-DC adaptor
- DC-DC converter
- Quick Charger
- Electric tool application
- Motor/Fan driving application
- Synchronous Rectifier for Power Delivery

Symbol and Pin assignment



Order Information

Item	Description
1. Order Code	DG60N02Q
2. Part Number	DG60N02Q
3. Package Type	PDFN5x6-8L
4. Package Code	Q
5. Packing Type	Tape & Reel
6. Quantity in Pack	2,500
7. RoHS Status	Halogen-Free

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

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V _{DS}	60	V
Gate-Source Voltage		V _{GS}	±20	V
Drain Current-Continuous ^{Note 1}	T _C =25°C	I _D	99	A
	T _C =100°C		62.6	A
Drain Current-Continuous ^{Note 2}	T _A =25°C	I _D	19.1	A
	T _A =70°C		15.3	A
Drain Current-Pulsed ^{Note 3}	T _A =25°C	I _{DM}	200	A
Avalanche Current		I _{AR}	25	A
Single Pulse Avalanche Energy ^{Note 4}		E _{AS}	31.2	mJ
Maximum Power Dissipation	T _C =25°C	P _D	78.1	W
	T _C =100°C		31.2	W
	T _A =25°C		2.9	W
	T _A =70°C		1.8	W
	Derate Factor Above TC=25°C		0.62	W/°C
Max. Operating Junction Temperature		T _J	150	°C
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	R _{ΘJC-N}	Please refer to Note 5	-	-	1.60	°C/W
Thermal resistance, Junction-Ambient	R _{ΘJA-N}	Please refer to Note 5	-	-	42.69	°C/W

Notes:

- Limited by silicon chip capability and R_{ΘJC-N} junction-to-case thermal resistance.
- The maximum current rating is limited by package and R_{ΘJA-N} junction-to-ambient thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width ≤ 380uS, Duty ≤ 2%)
- Limited by T_{Jmax}, starting T_J=25°C, L=0.1mH, R_g=25Ω, I_D=25A, V_{GS}=10V.
- The value of thermal resistance is measured with the single device mounted on 1 inch² FR-4 PCB with 2 oz. copper under a still air environment temperature is 25°C based on JEDEC standard JESD51-14 and JESD51-2a. Thermal resistance obtained depends on the user's specific board design and given application.

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	-	-	10	μA
Gate-Body Leakage	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA

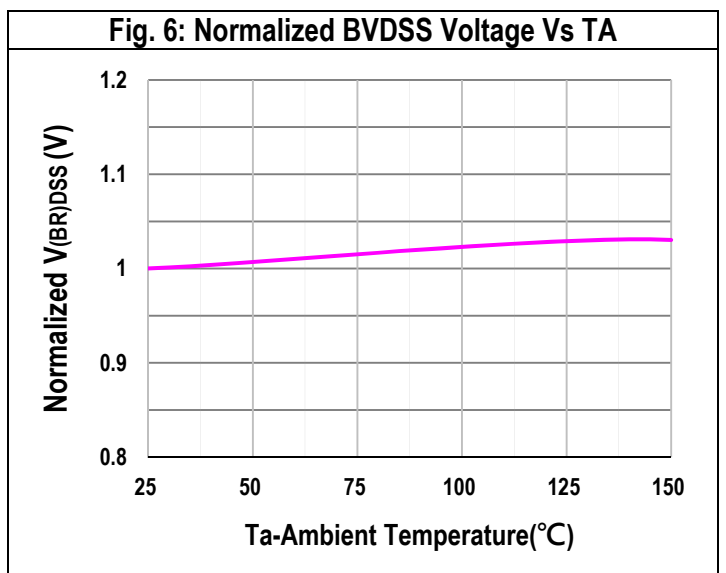
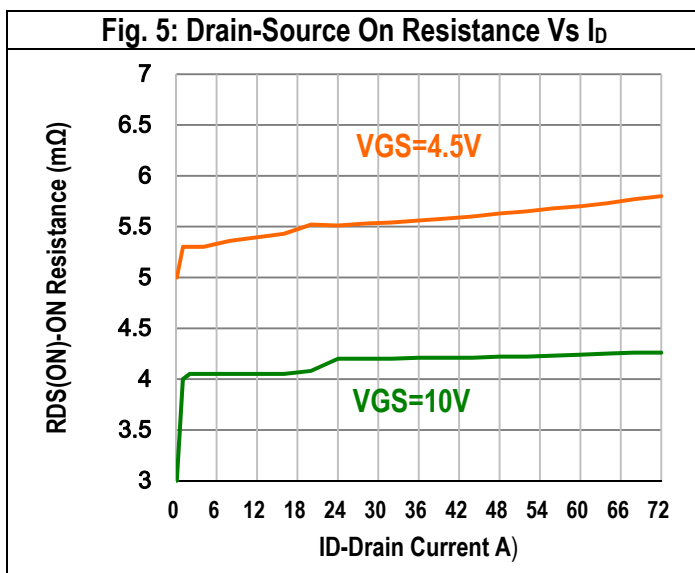
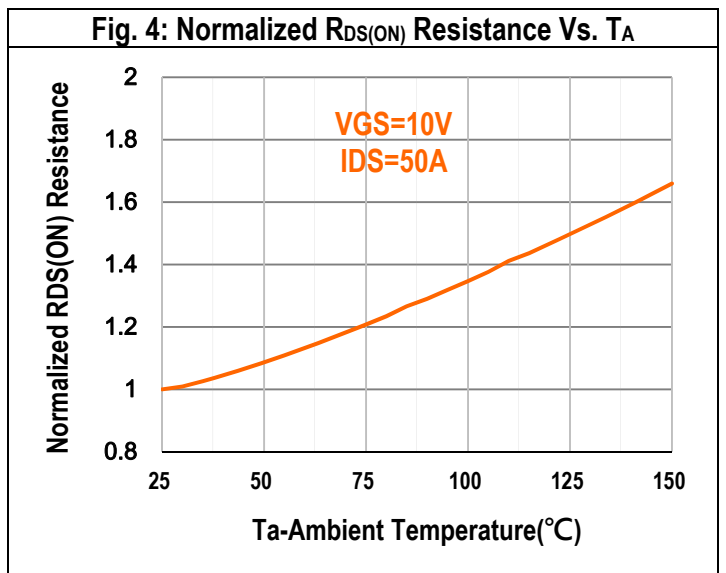
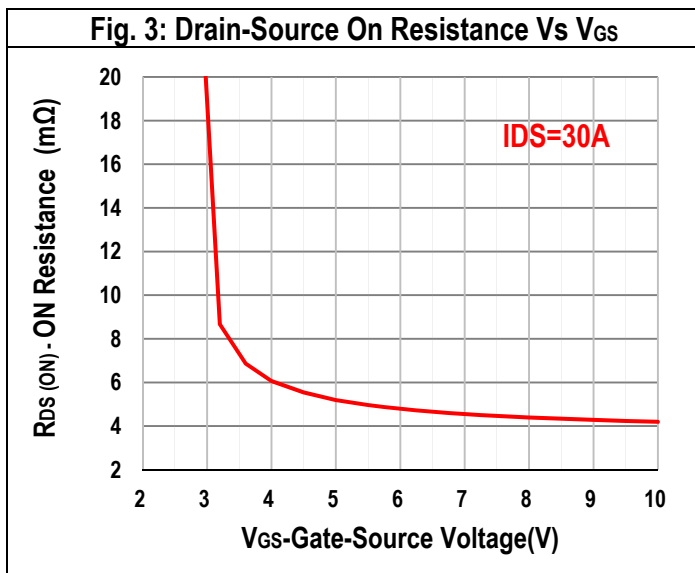
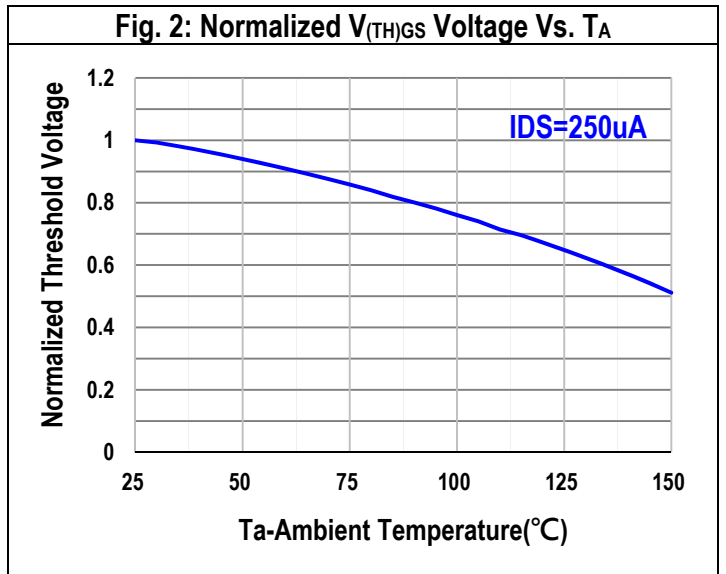
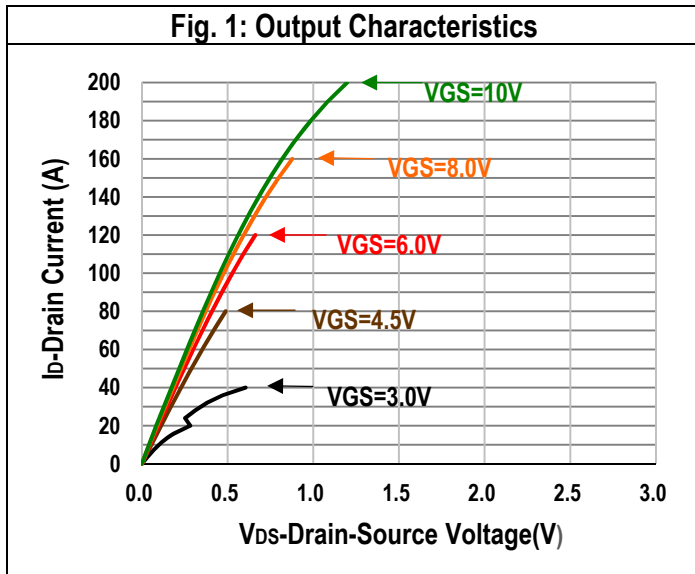
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _{DS} =250μA	1.2	1.5	1.8	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _{DS} =50A	-	4.2	4.8	mΩ
		V _{GS} =4.5V, I _{DS} =20A	-	5.5	6.3	mΩ
Gate Resistance	R _g	V _{GS} =0V, V _{DS} =0V, f=1MHz	-	0.9	-	Ω
Forward Transconductance	g _{fs}	V _{DS} =5V, I _{DS} =20A	-	32	-	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	-	2667	-	pF
Output Capacitance	C _{oss}	V _{DD} =60V, V _{DS} =30V, V _{GS} =0V, f=1MHz	-	1449	-	pF
Reverse Transfer Capacitance	C _{rss}	V _{DD} =60V, V _{DS} =30V, V _{GS} =0V, f=1MHz	-	66.4	-	pF
Turn-On Delay Time	T _{d(on)}	V _{DS} =30V, V _{GS} =10V, I _{DS} =30A, R _{GEN} =3Ω	-	11.2	-	nS
Rise Time	t _r	V _{DS} =30V, V _{GS} =10V, I _{DS} =30A, R _{GEN} =3Ω	-	44.2	-	nS
Turn-Off Delay Time	T _{d(off)}	V _{DS} =30V, V _{GS} =10V, I _{DS} =30A, R _{GEN} =3Ω	-	38.6	-	nS
Fall Time	t _f	V _{DS} =30V, V _{GS} =10V, I _{DS} =30A, R _{GEN} =3Ω	-	35.7	-	nS

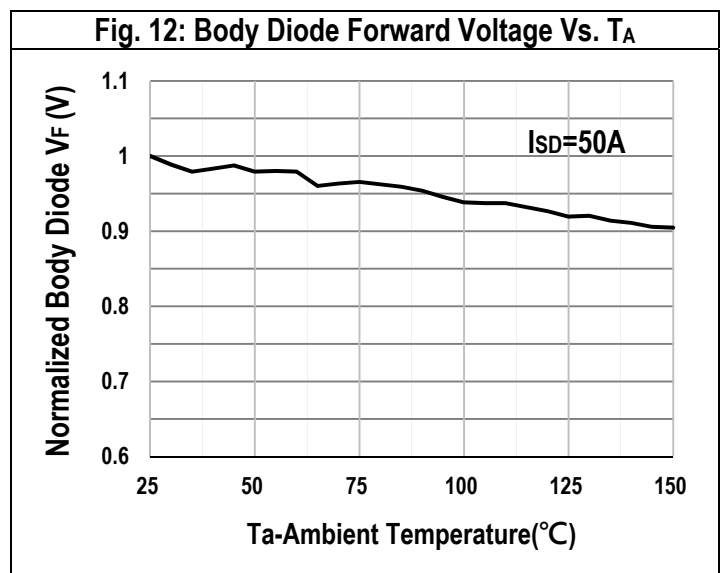
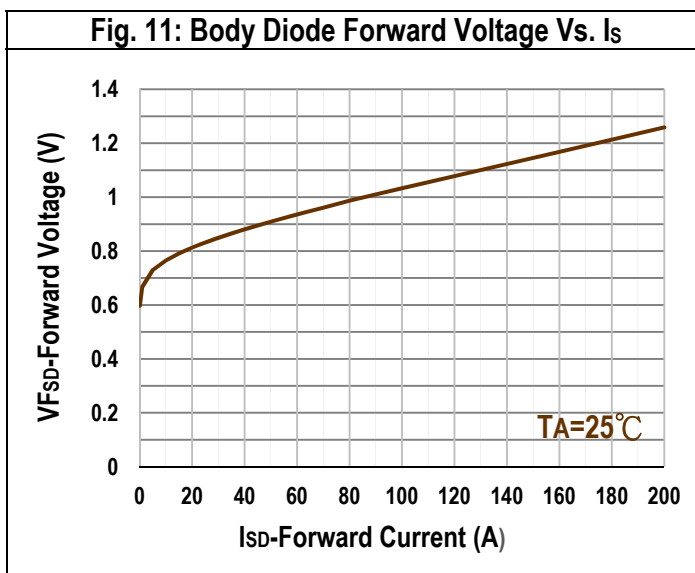
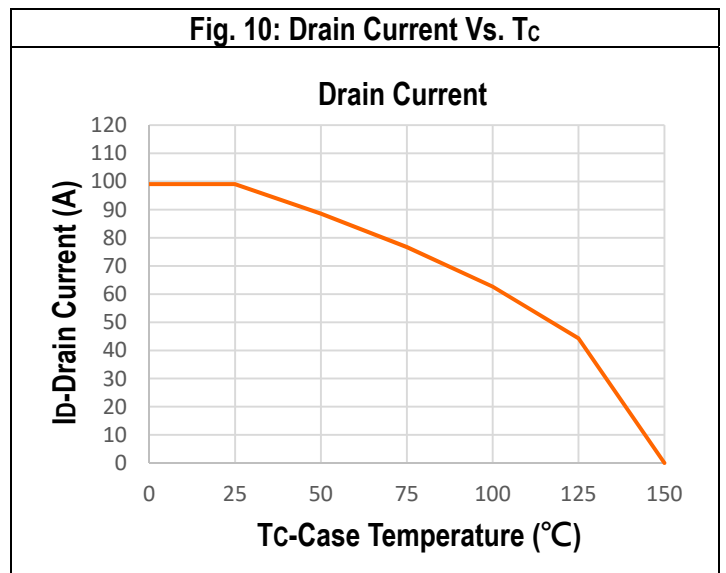
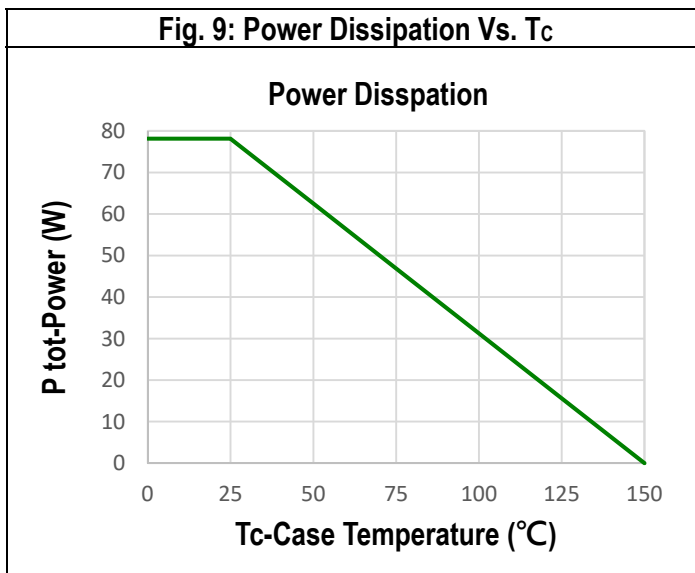
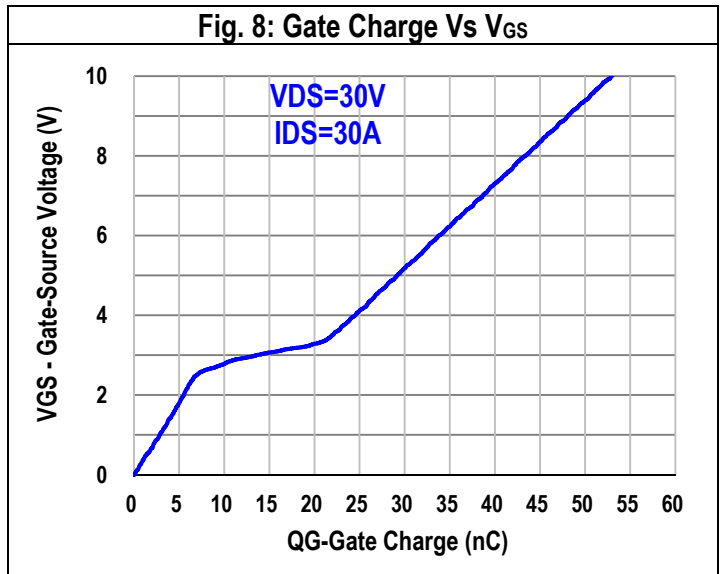
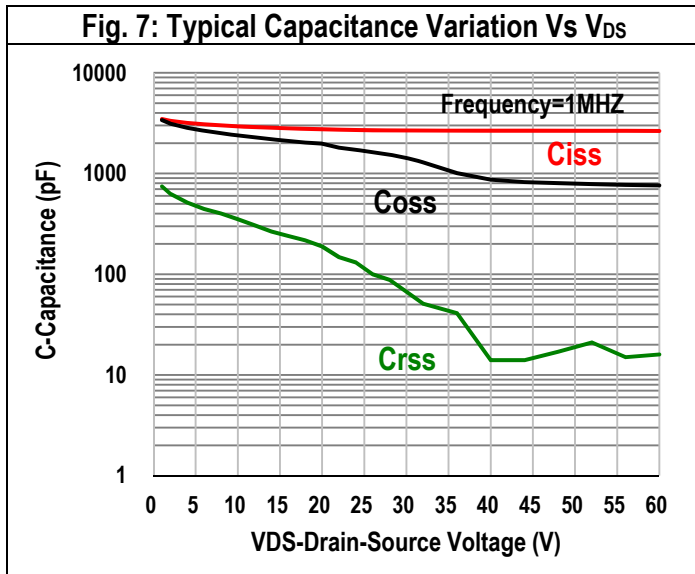
GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q _{gs}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	8.2	-	nC
Gate charge at threshold	Q _{g(th)}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	4.2	-	nC
Gate to Drain Charge	Q _{gd}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	13.2	-	nC
Switching charge	Q _{SW}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	17.1	-	nC
Gate charge total	Q _{g 10V}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	52.8	-	nC
	Q _{g 4.5V}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 4.5V	-	26.8	-	nC
Gate plateau voltage	V _{plateau}	V _{DD} =30V, I _D =30A, V _{GS} =0 to 10V	-	3.0	-	V
Gate charge total, sync. FET (Q _g - Q _{gd})	Q _{g(sync)}	V _{DS} =0.1V, V _{GS} =0 to 10V	-	39.6	-	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	-	-	99	A
Body diode pulse current	I _{SM}	T _C =25°C	-	-	200	A
Body diode forward voltage	V _{SD}	V _{GS} =0V, I _S =30A	-	0.85	1.0	V
Body diode reverse recovery time	t _{rr}	V _{DD} =30V, I _F =30A, di/dt=100A/μs	-	49.5	-	nS
Body diode reverse recovery charge	Q _{rr}	V _{DD} =30V, I _F =30A, di/dt=100A/μs	-	51.2	-	nC
Body diode peak reverse recovery charge	I _{rm}	V _{DD} =30V, I _F =30A, di/dt=100A/μs	-	1.9	-	A

Typical Operating Characteristics



Typical Operating Characteristics



Typical Operating Characteristics

Fig. 13: Safe Operation Area

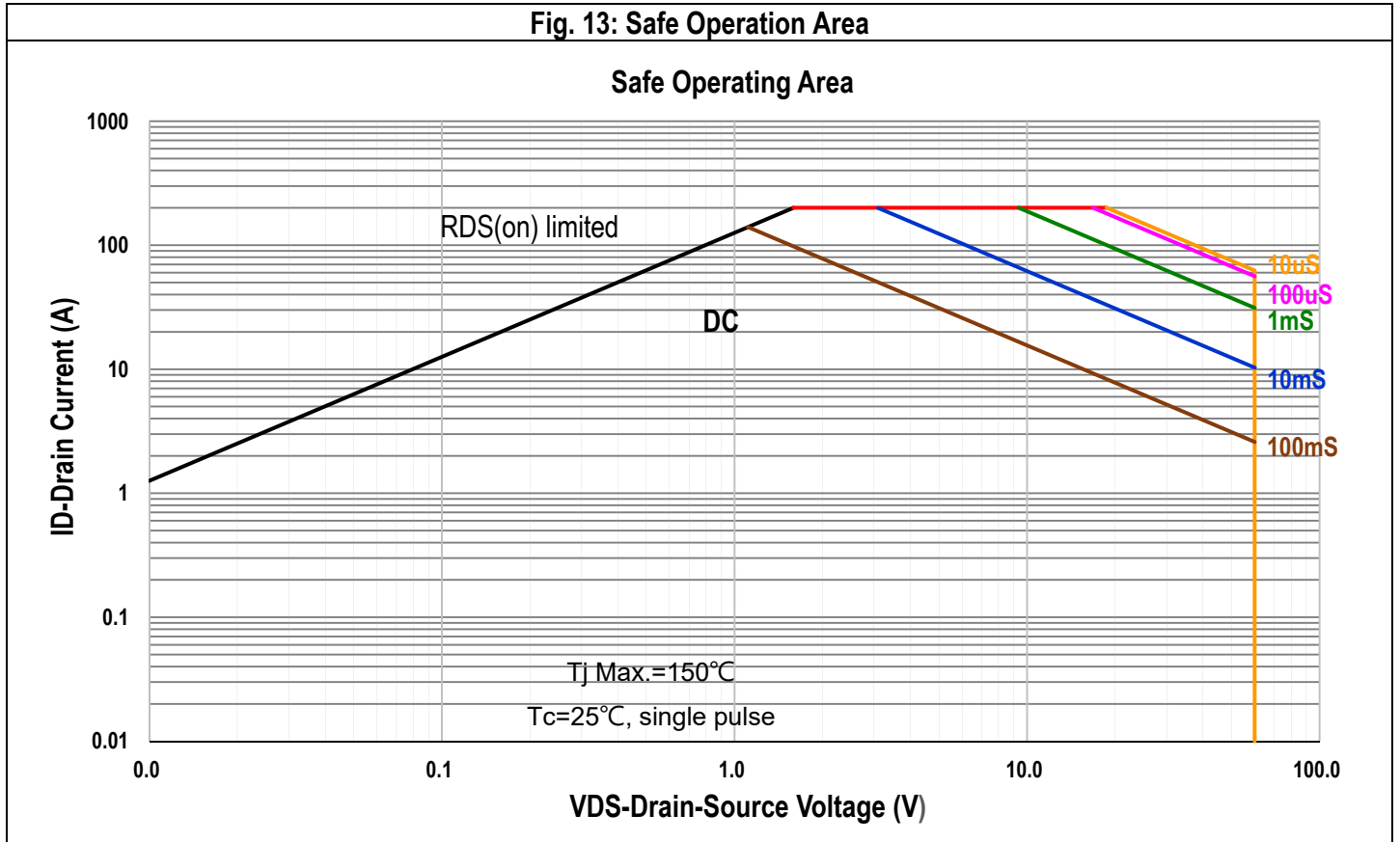
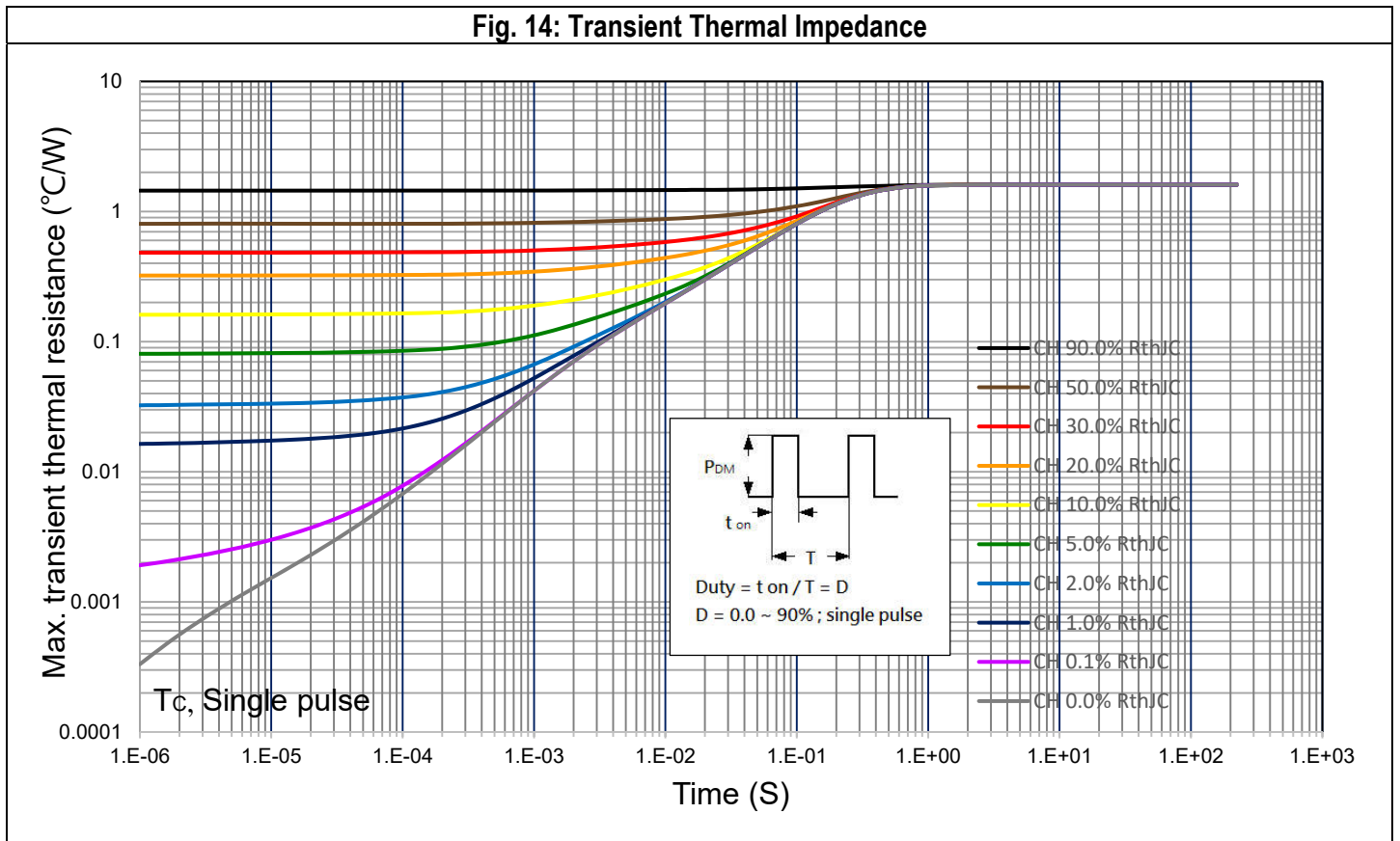



Fig. 14: Transient Thermal Impedance

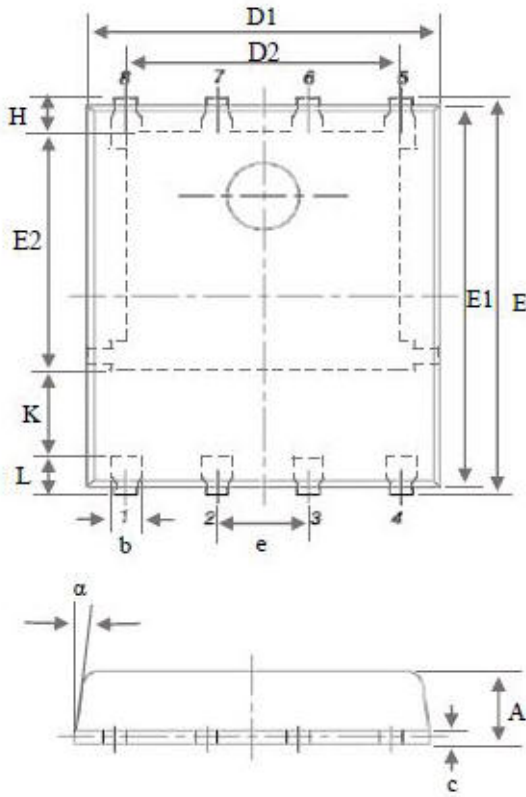


Marking Information

PDFN5x6-8L (Q)	Marking Rule
<p>Laser Marking</p> 	<p><u>Line 1</u> : Device DG60N02Q</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month Code XXX : Serial Number</p>

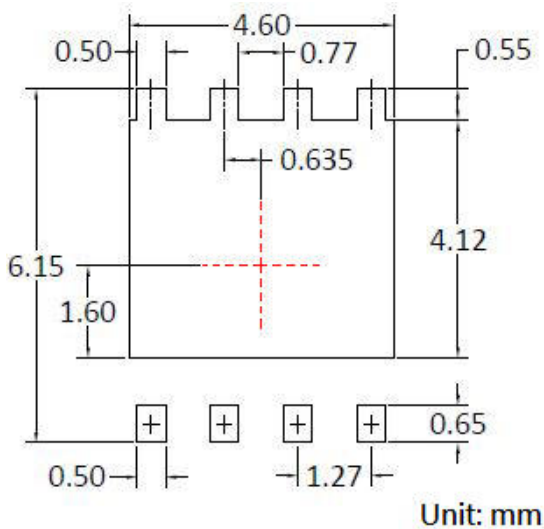
Package of Dimension

Package type: PDFN5x6-8L



Symbol	Min	Nor	Max
A	0.90	1.04	1.17
b	0.33	0.42	0.51
C	0.06	0.20	0.35
D1	4.80	5.10	5.40
D2	3.61	3.96	4.31
E	5.90	6.03	6.15
E1	5.65	5.75	5.85
E2	3.30	3.54	3.78
e	1.27 BSC		
H	0.38	0.50	0.61
L	0.38	0.55	0.71
L1	0.05	0.15	0.25

Land pattern (Footprint)

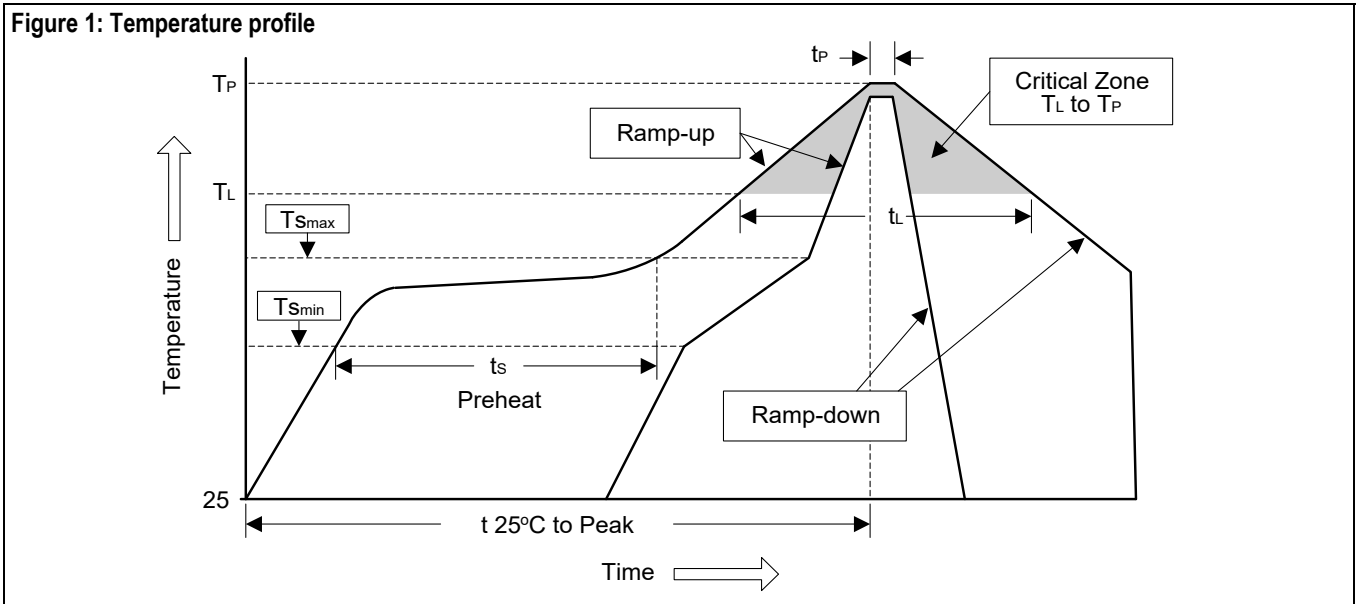


- Note 1: Land pattern (Footprint) design is for reference only.
- Note 2: Package body sizes exclude mold flash and burrs.
- Note 3: Dimension is measured in gauge plane.
- Note 4: Tolerance 0.1mm unless otherwise specified.

Appendix-A

Soldering Methods for Silicongear's Products (Just for SMD type of device)

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



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (TL to TP)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (Tsmmin)	100°C	150°C
- Temperature Max (Tsmmax)	150°C	200°C
- Time (min to max) (ts)	60 to 120 sec	60 to 180 sec
Tsmmax to TL		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (TL)	183°C	217°C
- Time (tL)	60 to 150 sec	60 to 150 sec
Peak Temperature (TP)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (tP)	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

Appendix-B

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