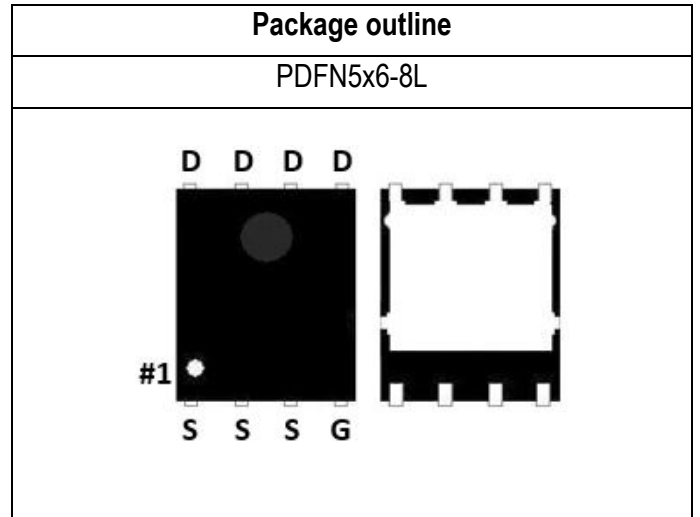


Key parameter	Value	Unit
$V_{(BR)DSS}$ min.	40	V
$R_{DS(ON)}$ max. $V_{GS}=10V$	5.8	mΩ
$R_{DS(ON)}$ max. $V_{GS}=4.5V$	8.6	mΩ
$V_{GS(TH)}$ Typ.	1.6	V
$I_D$	80.1	A
$Q_g$ 10V Typ.	19.6	nC
$C_{iss}$ Typ.	925	pF
$E_{AS}$	18	mJ



### Description

These devices use 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.

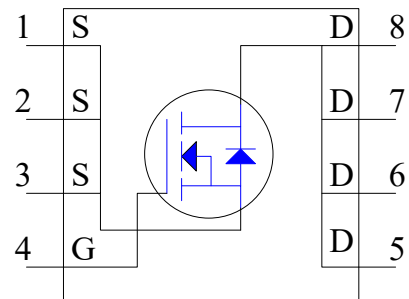
### Features

- ◇ 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	DG40N20Q
2. Part Number	DG40N20Q
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<sub>J</sub>=25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V <sub>DS</sub>	40	V
Gate-Source Voltage		V <sub>GS</sub>	±20	V
Drain Current-Continuous <sup>Note 1</sup>	T <sub>C</sub> =25°C	I <sub>D</sub>	80.1	A
	T <sub>C</sub> =100°C		50.7	A
Drain Current-Continuous <sup>Note 2</sup>	T <sub>A</sub> =25°C	I <sub>D</sub>	19.5	A
	T <sub>A</sub> =70°C		15.6	A
Drain Current-Pulsed <sup>Note 3</sup>	T <sub>A</sub> =25°C	I <sub>DM</sub>	140	A
Avalanche Current		I <sub>AR</sub>	19	A
Single Pulse Avalanche Energy <sup>Note 4</sup>		E <sub>AS</sub>	18	mJ
Maximum Power Dissipation	T <sub>C</sub> =25°C	P <sub>D</sub>	52.7	W
	T <sub>C</sub> =100°C		21	W
	T <sub>A</sub> =25°C		3.1	W
	T <sub>A</sub> =70°C		2.0	W
	Derate Factor Above TC=25°C		0.42	W/°C
Max. Operating Junction Temperature		T <sub>J</sub>	150	°C
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

### Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance, Junction-Case	R <sub>ΘJC-N</sub>	Please refer to Note 5	-	-	2.37	°C/W
Thermal resistance, Junction-Ambient	R <sub>ΘJA-N</sub>	Please refer to Note 5	-	-	40.03	°C/W

#### Notes:

- Limited by silicon chip capability and R<sub>ΘJC-N</sub> junction-to-case thermal resistance.
- The maximum current rating is limited by package and R<sub>ΘJA-P</sub> junction-to-ambient thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width ≤ 380uS, Duty ≤ 2%)
- Limited by T<sub>Jmax</sub>, starting T<sub>J</sub>=25°C, L=0.1mH, R<sub>g</sub>=25Ω, I<sub>D</sub>=19A, V<sub>GS</sub>=10V.
- The value of thermal resistance is measured with the single device mounted on 1 inch<sup>2</sup> 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<sub>J</sub>=25°C unless otherwise noted)**

STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V	-	-	1	μA
		V <sub>DS</sub> =40V, V <sub>GS</sub> =0V, T <sub>J</sub> =125°C	-	-	10	μA
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA

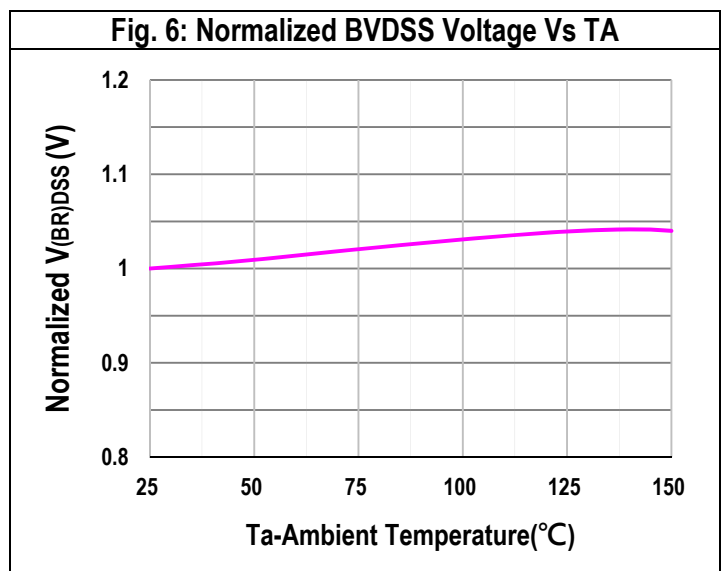
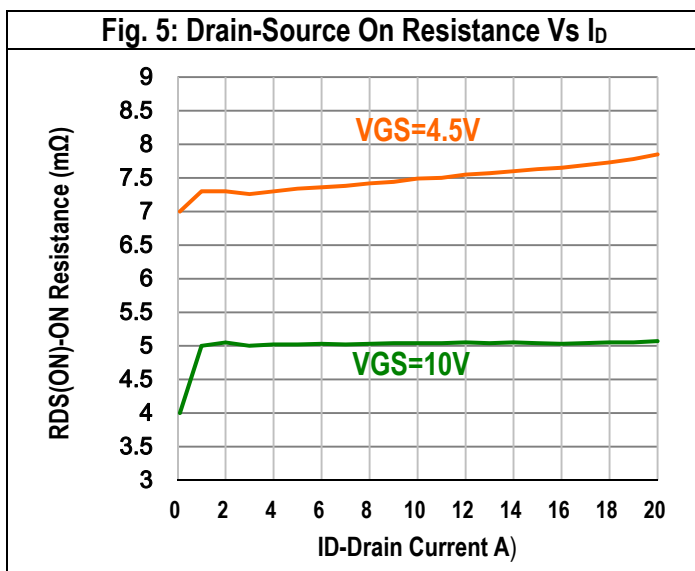
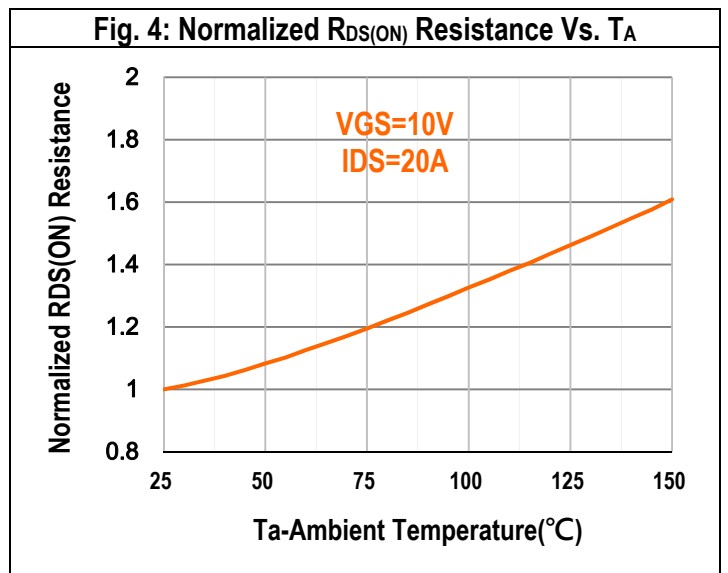
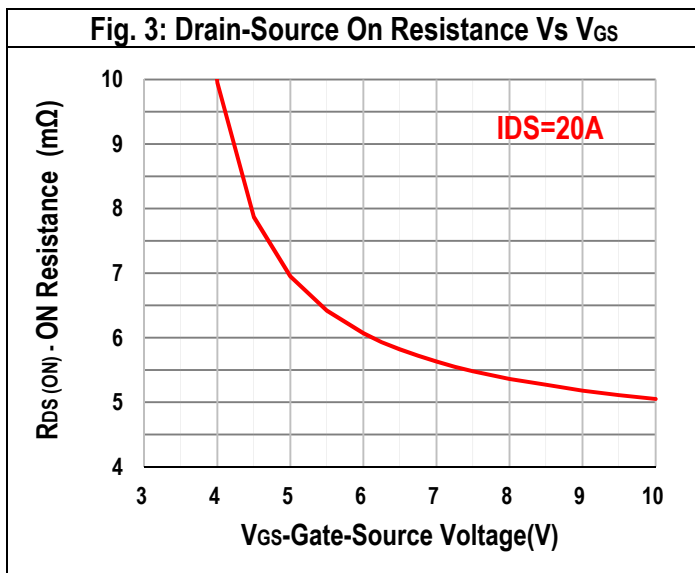
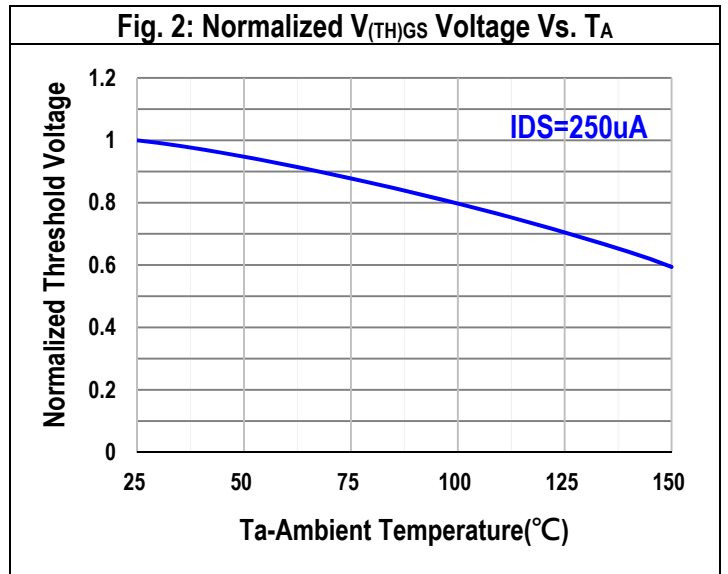
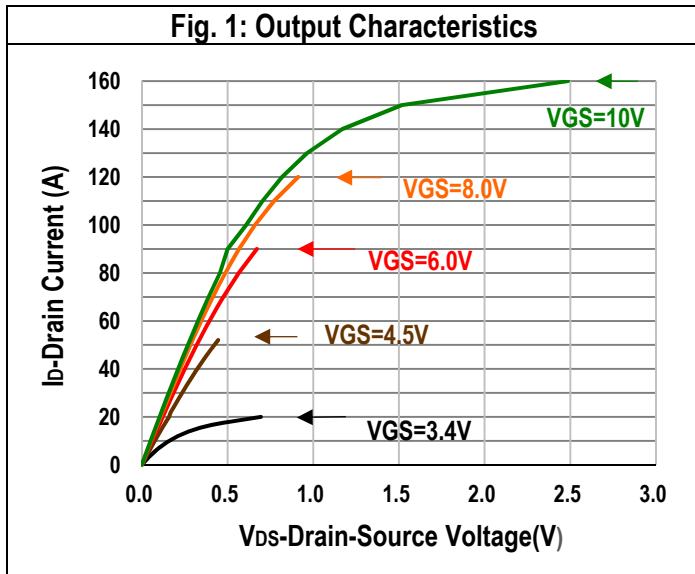
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1.3	1.6	1.9	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>DS</sub> =20A	-	5.1	5.8	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =15A	-	7.5	8.6	mΩ
Gate Resistance	R <sub>g</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz	-	2.5	-	Ω
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =5V, I <sub>DS</sub> =15A	-	17.5	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C <sub>iss</sub>	V <sub>DD</sub> =40V, V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz	-	925	-	pF
Output Capacitance	C <sub>oss</sub>	V <sub>DD</sub> =40V, V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz	-	368	-	pF
Reverse Transfer Capacitance	C <sub>rss</sub>	V <sub>DD</sub> =40V, V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz	-	48	-	pF
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3Ω	-	7.3	-	nS
Rise Time	t <sub>r</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3Ω	-	44	-	nS
Turn-Off Delay Time	T <sub>d(off)</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3Ω	-	22.1	-	nS
Fall Time	t <sub>f</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A, R <sub>GEN</sub> =3Ω	-	19.5	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q <sub>gs</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	3.3	-	nC
Gate charge at threshold	Q <sub>g(th)</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	1.7	-	nC
Gate to Drain Charge	Q <sub>gd</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	5.3	-	nC
Switching charge	Q <sub>SW</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	6.8	-	nC
Gate charge total	Q <sub>g 10V</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	19.6	-	nC
	Q <sub>g 4.5V</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 4.5V	-	10	-	nC
Gate plateau voltage	V <sub>plateau</sub>	V <sub>DD</sub> =20V, I <sub>D</sub> =20A, V <sub>GS</sub> =0 to 10V	-	3.3	-	V
Gate charge total, sync. FET (Q <sub>g</sub> - Q <sub>gd</sub> )	Q <sub>g(sync)</sub>	V <sub>DS</sub> =0.1V, V <sub>GS</sub> =0 to 10V	-	14.3	-	nC

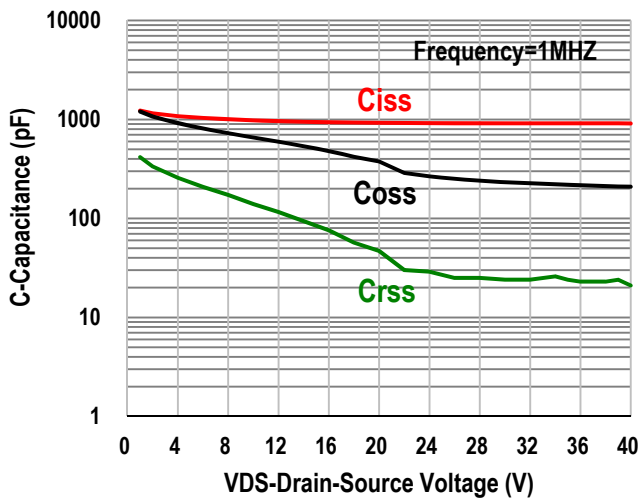
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Body diode continuous forward current	I <sub>S</sub>	T <sub>C</sub> =25°C	-	-	80.1	A
Body diode pulse current	I <sub>SM</sub>	T <sub>C</sub> =25°C	-	-	140	A
Body diode forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =20A	-	0.85	1.0	V
Body diode reverse recovery time	t <sub>rr</sub>	V <sub>DD</sub> =20V, I <sub>F</sub> =20A, di/dt=100A/μs	-	23	-	nS
Body diode reverse recovery charge	Q <sub>rr</sub>	V <sub>DD</sub> =20V, I <sub>F</sub> =20A, di/dt=100A/μs	-	8.3	-	nC
Body diode peak reverse recovery charge	I <sub>rm</sub>	V <sub>DD</sub> =20V, I <sub>F</sub> =20A, di/dt=100A/μs	-	0.75	-	A

## Typical Operating Characteristics

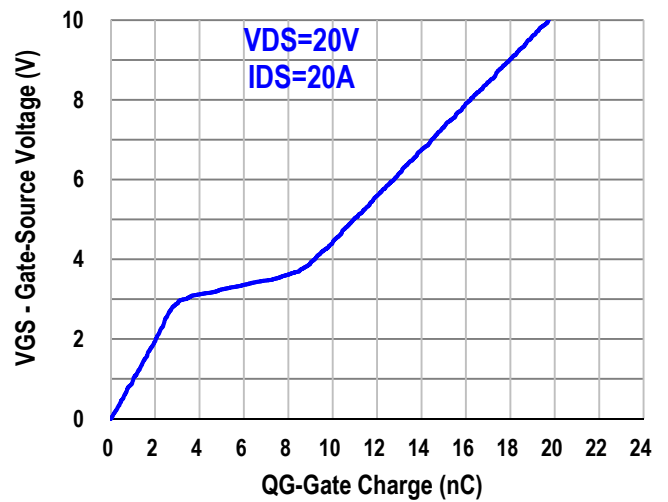


## Typical Operating Characteristics

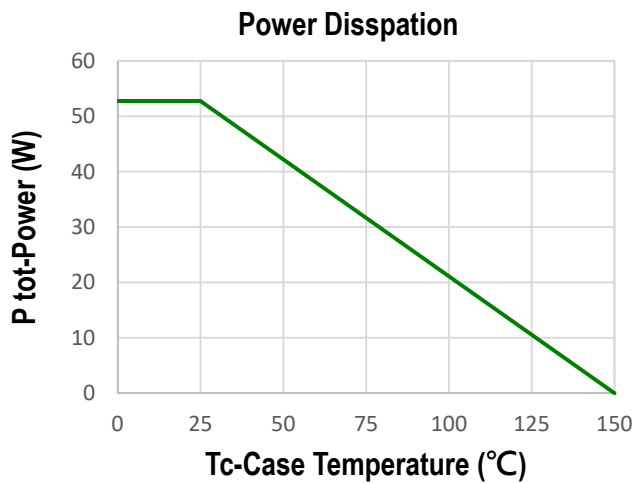
**Fig. 7: Typical Capacitance Variation Vs  $V_{DS}$**



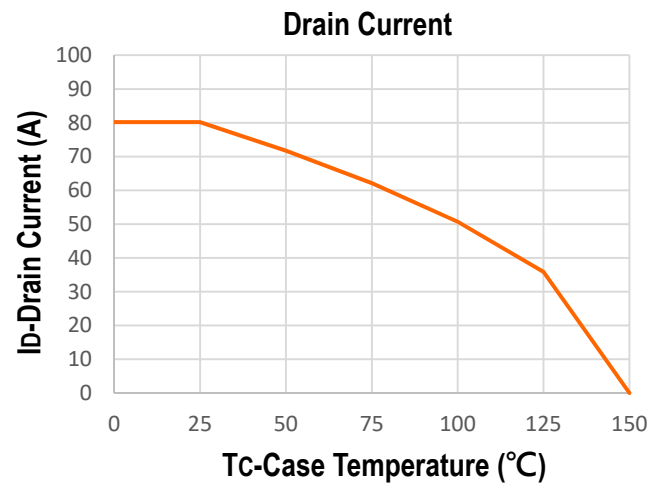
**Fig. 8: Gate Charge Vs  $V_{GS}$**



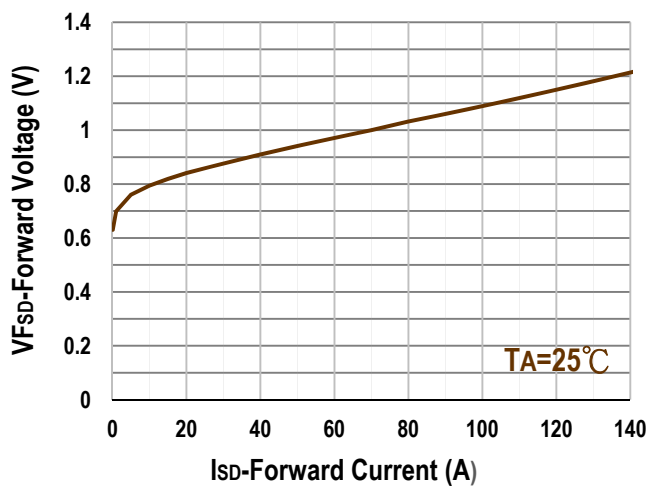
**Fig. 9: Power Dissipation Vs.  $T_c$**



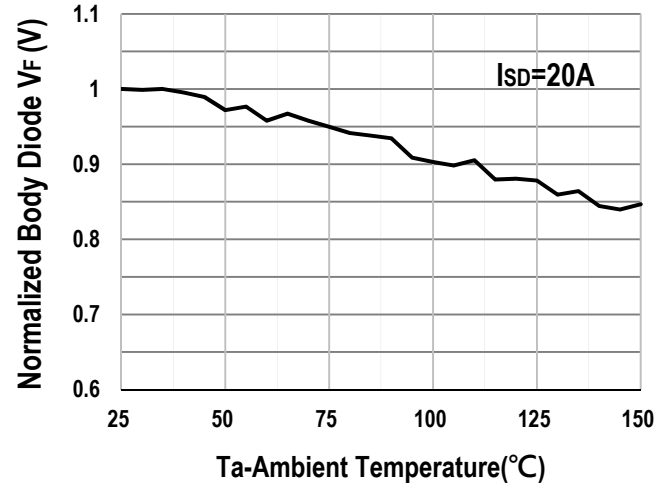
**Fig. 10: Drain Current Vs.  $T_c$**



**Fig. 11: Body Diode Forward Voltage Vs.  $I_s$**

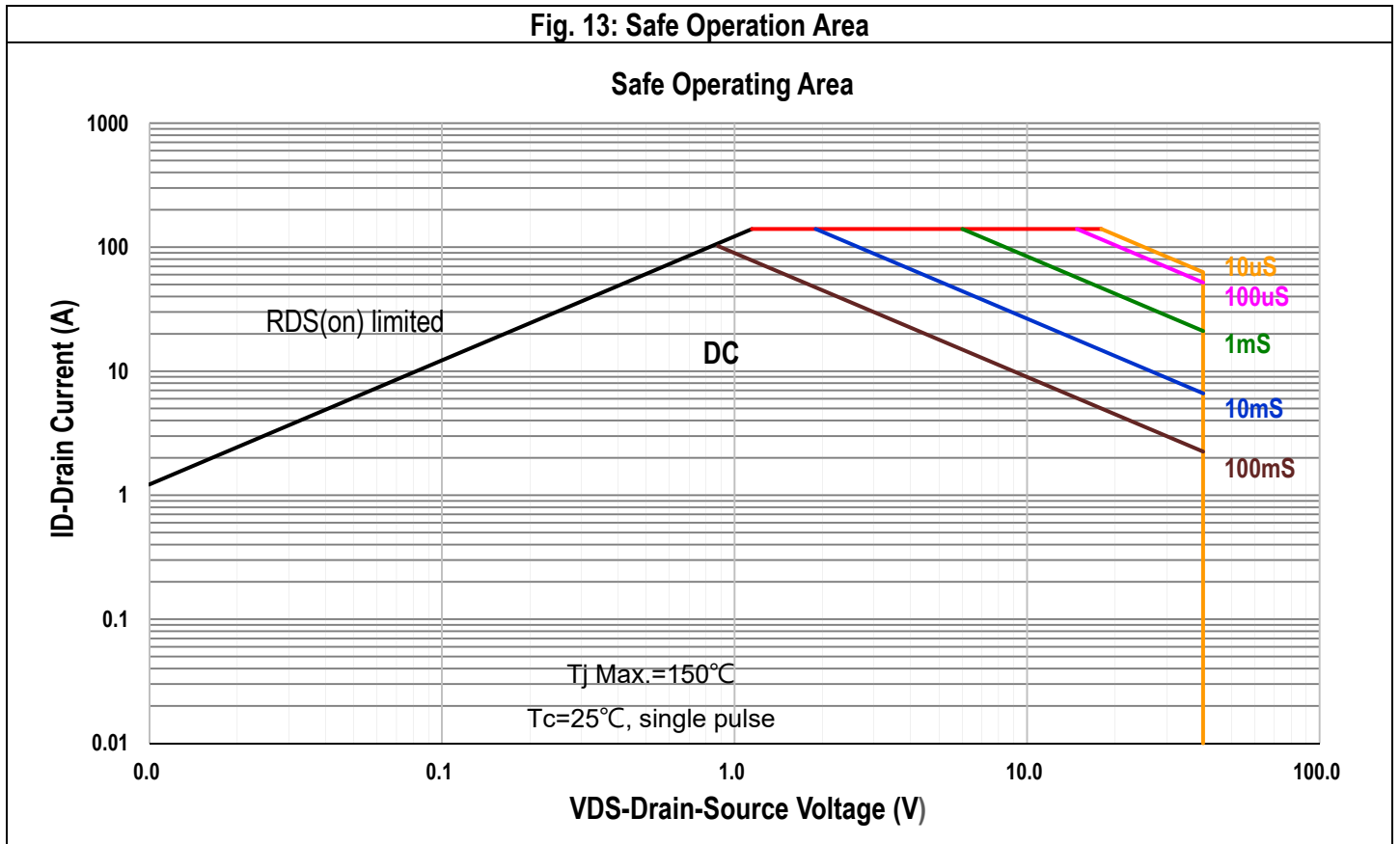


**Fig. 12: Body Diode Forward Voltage Vs.  $T_A$**

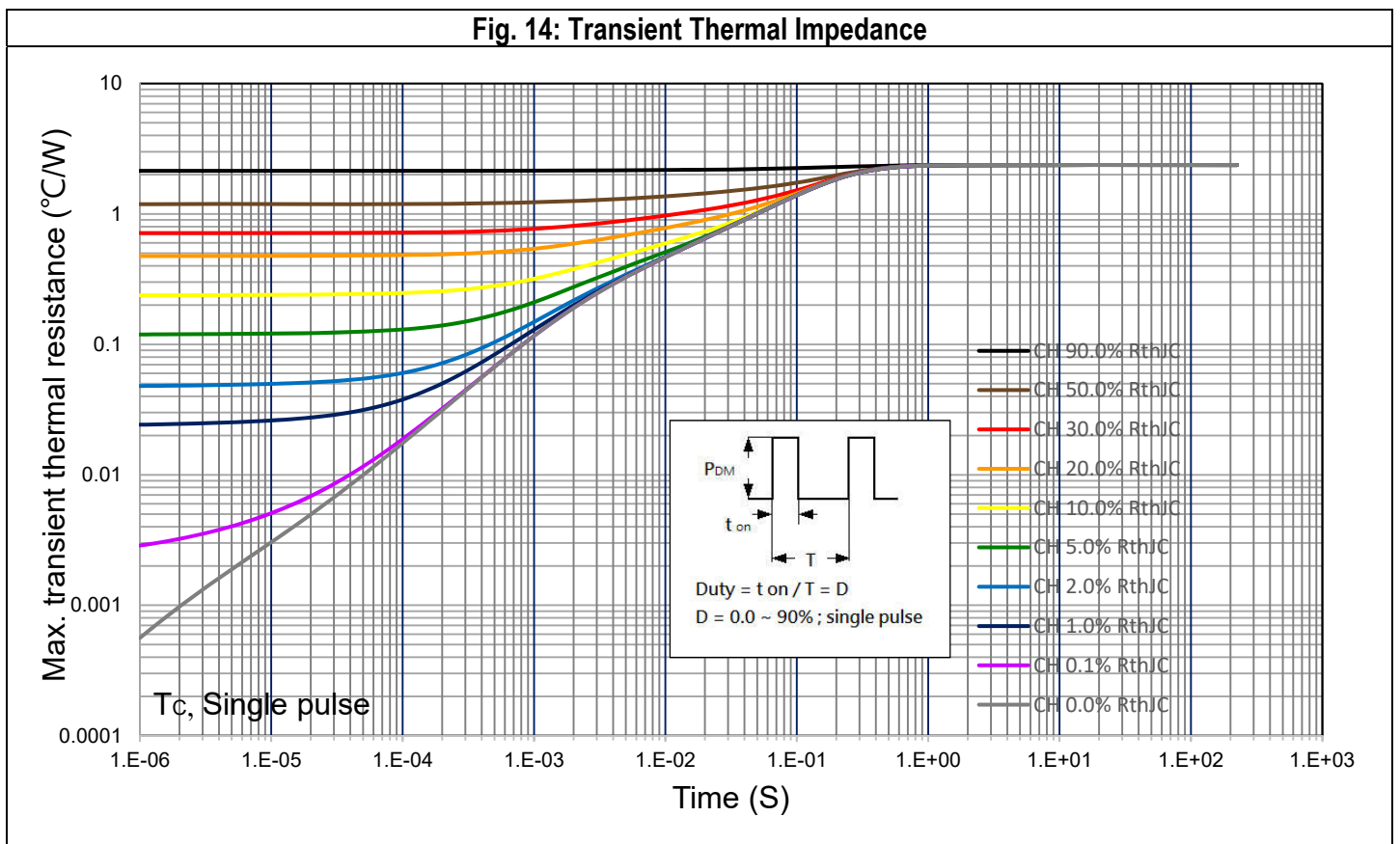


Typical Operating Characteristics


**Fig. 13: Safe Operation Area**



**Fig. 14: Transient Thermal Impedance**

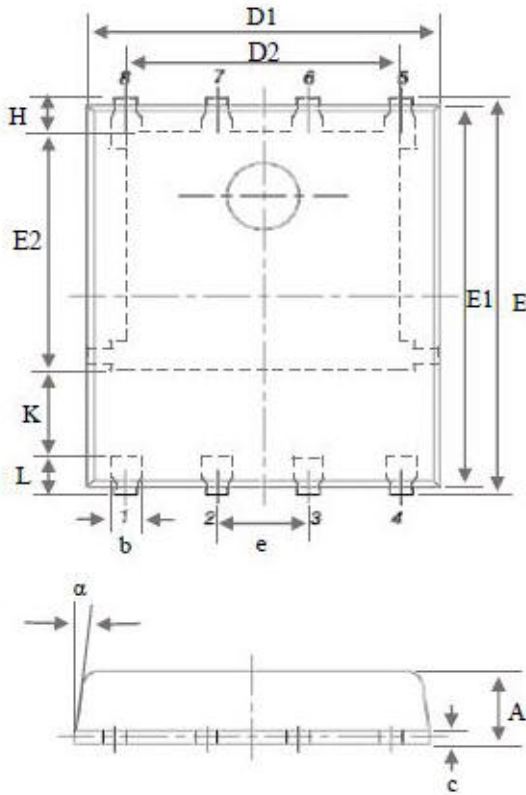


## Marking Information

PDFN5x6-8L (Q)	Marking Rule
<p>Laser Marking</p> 	<p><u>Line 1</u> : Device DG40N20Q</p> <p><u>Line 2</u> : Date Code YYMMXXX</p> <p>YY : Year Code MM : Month Code XXX : Serial Number</p>

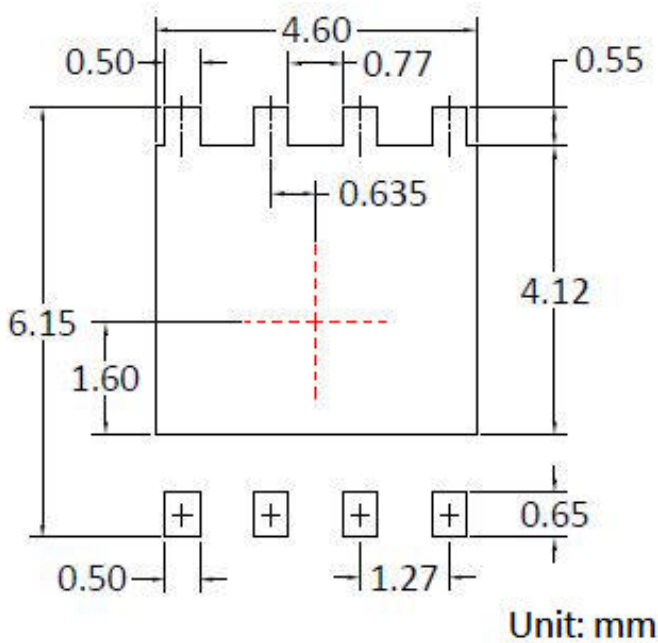
## Package of Dimension

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.

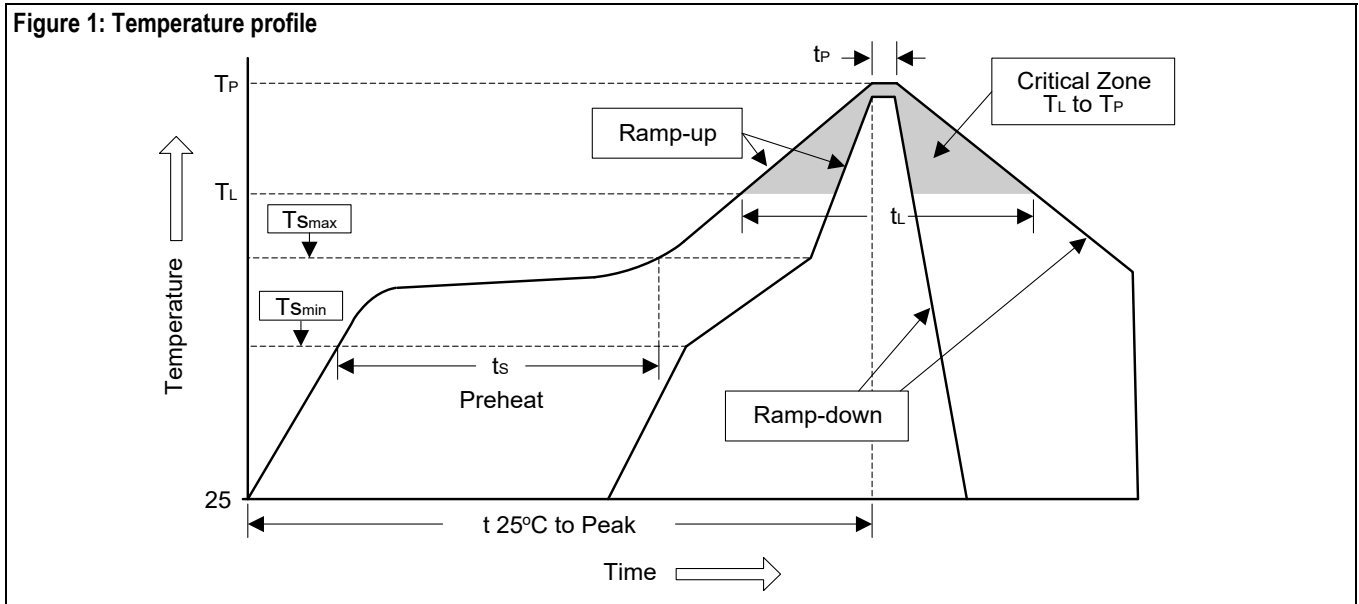
Note 4: Tolerance 0.1mm unless otherwise specified.



## Appendix-A

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

1. Storage environment: Temperature=10°C to 35°C Humidity=65%±15%
2. 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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