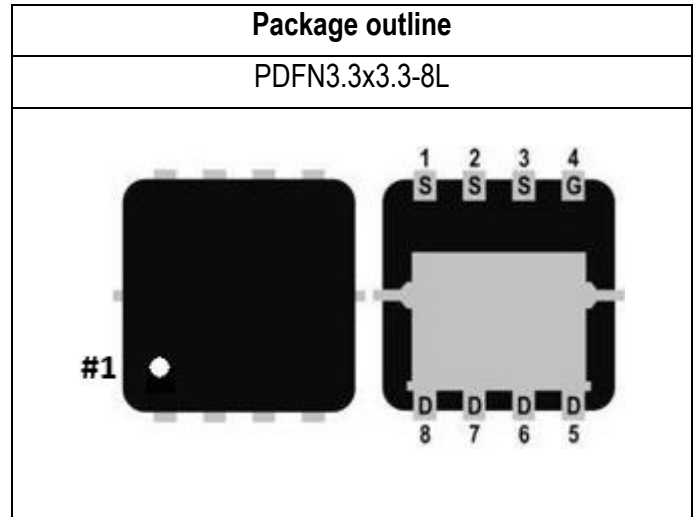


Key parameter	Value	Unit
$V_{(BR)DSS}$ min.	40	V
$R_{DS(ON)}$ max. $V_{GS}=10V$	6.2	m Ω
$R_{DS(ON)}$ max. $V_{GS}=4.5V$	8.9	m Ω
$V_{GS(TH)}$ Typ.	1.6	V
I_D	53.4	A
Q_g 10V Typ.	19.6	nC
C_{iss} Typ.	923	pF
E_{AS}	19.4	mJ



Description

The DG40N20E uses 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.

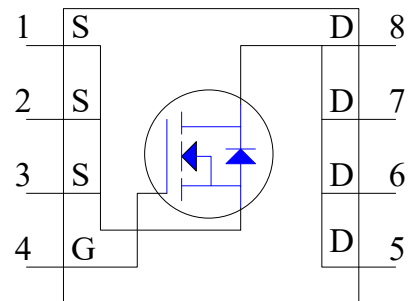
Features

- ◇ Fast switch capability
- ◇ 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	DG40N20E
2. Part Number	DG40N20E
3. Package Type	PDFN3.3x3.3-8L
4. Package Code	E
5. Packing Type	Tape & Reel
6. Quantity in Pack	5,000
7. RoHS Status	Halogen-Free

Absolute Maximum Ratings ($T_J=25^\circ\text{C}$ unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	± 20	V
Drain Current-Continuous ^{Note 1}	$T_C=25^\circ\text{C}$	I_D	53.4	A
	$T_C=100^\circ\text{C}$		33.8	A
Drain Current-Continuous ^{Note 2}	$T_A=25^\circ\text{C}$	I_D	15.0	A
	$T_A=70^\circ\text{C}$		12.0	A
Drain Current-Pulsed ^{Note 3}	$T_A=25^\circ\text{C}$	I_{DM}	140	A
Avalanche Current		I_{AR}	19.7	A
Single Pulse Avalanche Energy ^{Note 4}		E_{AS}	19.4	mJ
Maximum Power Dissipation	$T_C=25^\circ\text{C}$	P_D	27.6	W
	$T_C=100^\circ\text{C}$		11.0	W
	$T_A=25^\circ\text{C}$		2.1	W
	$T_A=70^\circ\text{C}$		1.4	W
	Derate Factor Above $T_C=25^\circ\text{C}$		0.22	W/ $^\circ\text{C}$
Max. Operating Junction Temperature		T_J	150	$^\circ\text{C}$
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal resistance, Junction-Case	$R_{\theta JC-N}$	Please refer to Note 5	-	-	4.52	$^\circ\text{C}/\text{W}$
Thermal resistance, Junction-Ambient	$R_{\theta JA-N}$	Please refer to Note 5	-	-	56.82	$^\circ\text{C}/\text{W}$

Notes:

- Limited by silicon chip capability and $R_{\theta JC-N}$ junction-to-case thermal resistance.
- The maximum current rating is limited by package and $R_{\theta JA-N}$ junction-to-ambient thermal resistance.
- Must be ensure junction temperature does not exceed 150-degree C. (Pulse Width $\leq 380\mu\text{s}$, Duty $\leq 2\%$)
- Limited by T_{Jmax} , starting $T_J=25^\circ\text{C}$, $L=0.1\text{mH}$, $R_g=25\Omega$, $I_D=19.7\text{A}$, $V_{GS}=10\text{V}$.
- 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	40	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =40V, V _{GS} =0V	-	-	1	μA
		V _{DS} =40V, V _{GS} =0V, T _J =125°C	-	-	10	μA
Gate-Body Leakage	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA

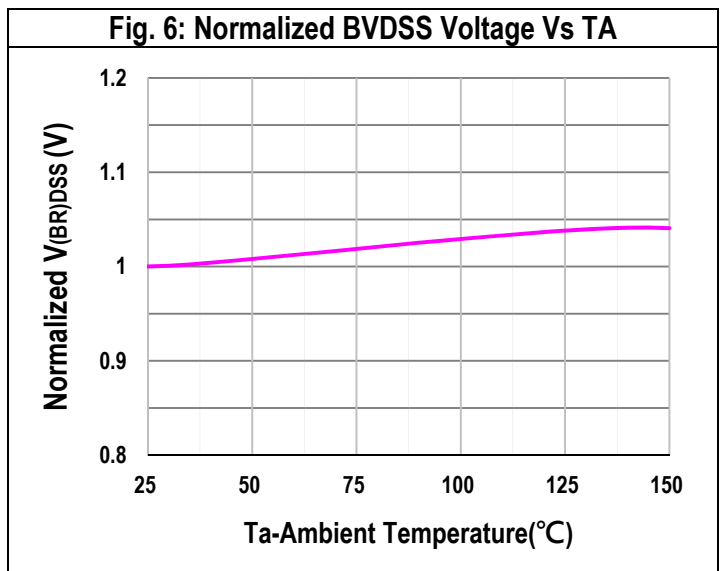
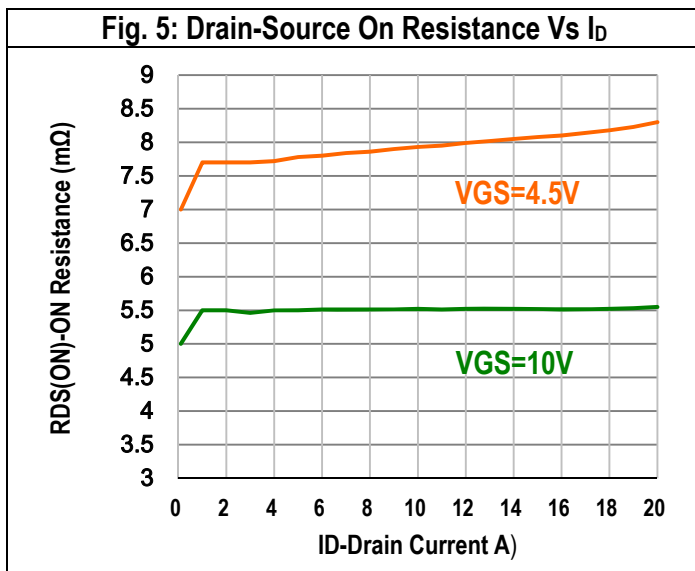
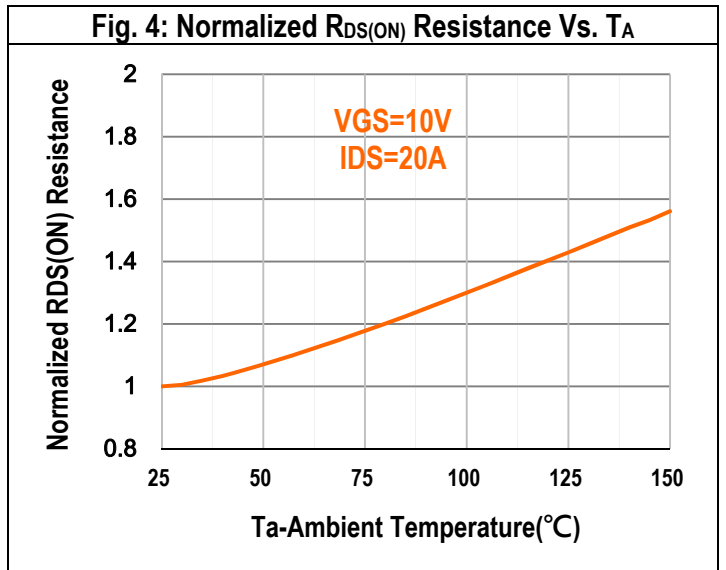
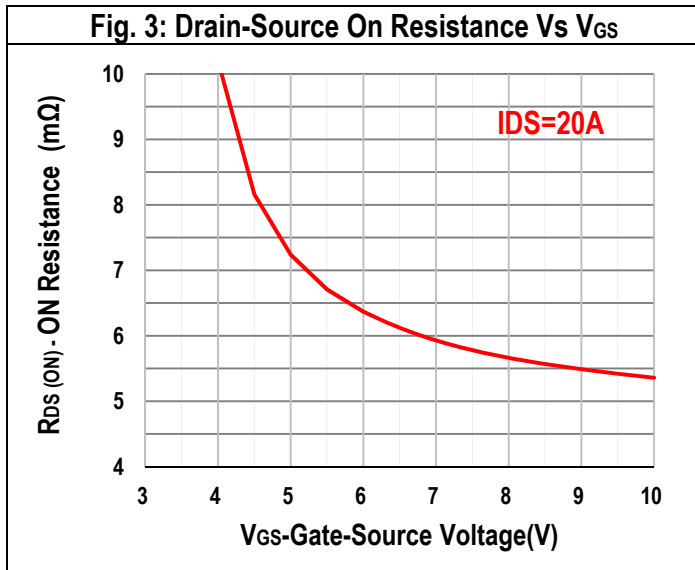
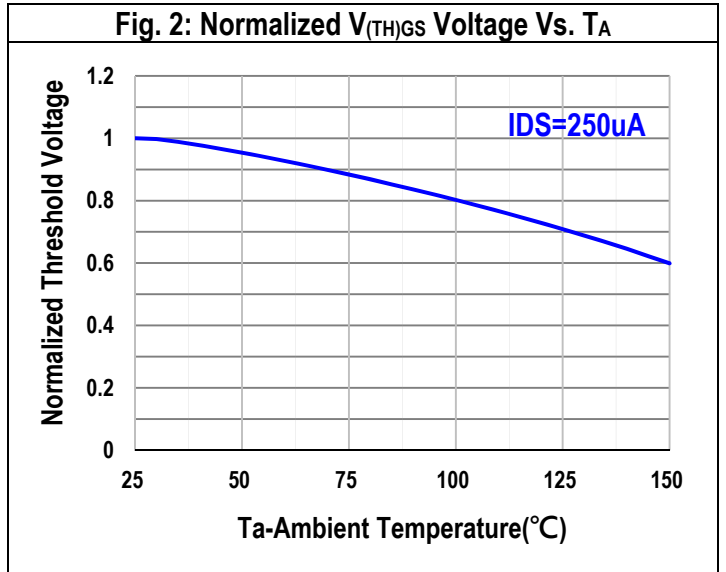
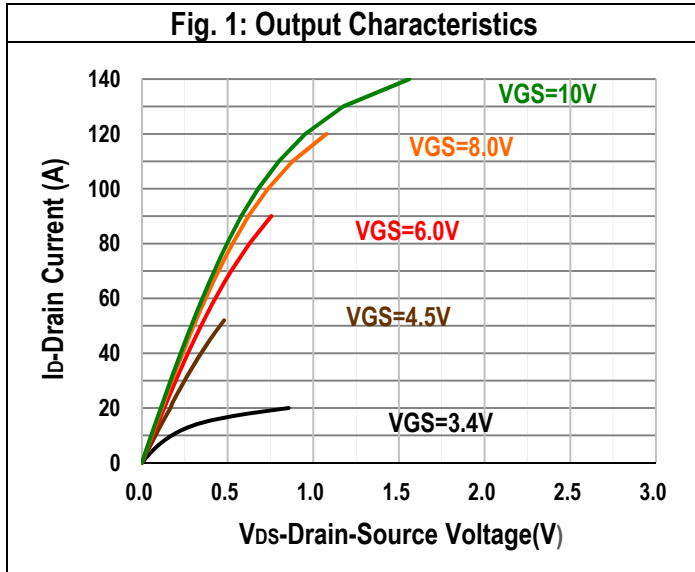
STATIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _{DS} =250μA	1.3	1.6	1.9	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _{DS} =20A	-	5.4	6.2	mΩ
		V _{GS} =4.5V, I _{DS} =15A	-	7.8	8.9	mΩ
Gate Resistance	R _g	V _{GS} =0V, V _{DS} =0V, f=1MHz	-	2.5	-	Ω
Forward Transconductance	g _{fs}	V _{DS} =5V, I _{DS} =15A	-	12	-	S

DYNAMIC CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input Capacitance	C _{iss}	V _{DD} =40V, V _{DS} =20V, V _{GS} =0V, f=1MHz	-	923	-	pF
Output Capacitance	C _{oss}	V _{DD} =40V, V _{DS} =20V, V _{GS} =0V, f=1MHz	-	376	-	pF
Reverse Transfer Capacitance	C _{rss}	V _{DD} =40V, V _{DS} =20V, V _{GS} =0V, f=1MHz	-	47	-	pF
Turn-On Delay Time	T _{d(on)}	V _{DS} =20V, V _{GS} =10V, I _{DS} =20A, R _{GEN} =3Ω	-	7.1	-	nS
Rise Time	t _r	V _{DS} =20V, V _{GS} =10V, I _{DS} =20A, R _{GEN} =3Ω	-	43.1	-	nS
Turn-Off Delay Time	T _{d(off)}	V _{DS} =20V, V _{GS} =10V, I _{DS} =20A, R _{GEN} =3Ω	-	21.7	-	nS
Fall Time	t _f	V _{DS} =20V, V _{GS} =10V, I _{DS} =20A, R _{GEN} =3Ω	-	18.9	-	nS

GATE CHARGE CHARACTERISTICS						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Gate to Source Gate Charge	Q _{gs}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	3.4	-	nC
Gate charge at threshold	Q _{g(th)}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	1.6	-	nC
Gate to Drain Charge	Q _{gd}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	5.2	-	nC
Switching charge	Q _{SW}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	6.9	-	nC
Gate charge total	Q _{g 10V}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	19.6	-	nC
	Q _{g 4.5V}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 4.5V	-	10.0	-	nC
Gate plateau voltage	V _{plateau}	V _{DD} =20V, I _D =20A, V _{GS} =0 to 10V	-	3.3	-	V
Gate charge total, sync. FET (Q _g - Q _{gd})	Q _{g(sync)}	V _{DS} =0.1V, V _{GS} =0 to 10V	-	14.4	-	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	-	-	53.4	A
Body diode pulse current	I _{SM}	T _C =25°C	-	-	140	A
Body diode forward voltage	V _{SD}	V _{GS} =0V, I _S =20A	-	0.85	1.0	V
Body diode reverse recovery time	t _{rr}	V _{DD} =20V, I _F =20A, di/dt=100A/μs	-	17.6	-	nS
Body diode reverse recovery charge	Q _{rr}	V _{DD} =20V, I _F =20A, di/dt=100A/μs	-	4.3	-	nC
Body diode peak reverse recovery charge	I _{rm}	V _{DD} =20V, I _F =20A, di/dt=100A/μs	-	0.52	-	A

Typical Operating Characteristics



Typical Operating Characteristics

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

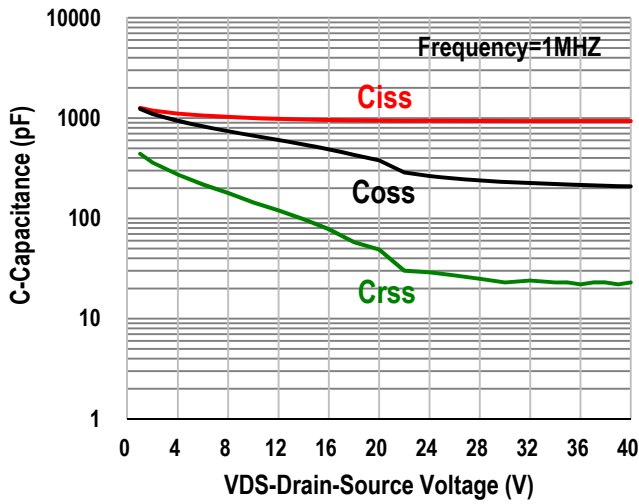


Fig. 8: Gate Charge Vs V_{GS}

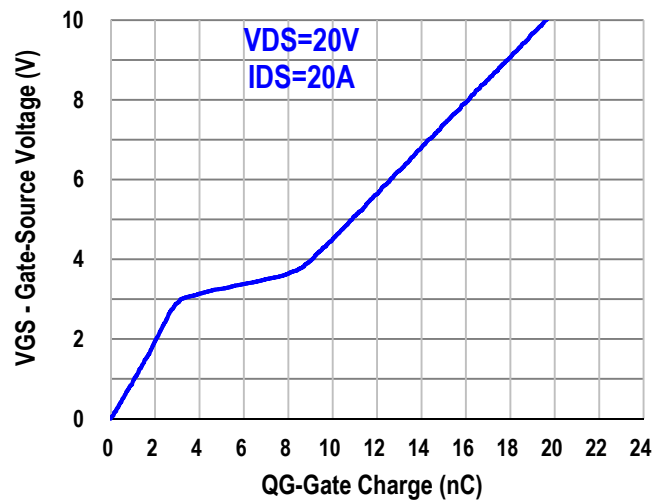


Fig. 9: Power Dissipation Vs. T_c

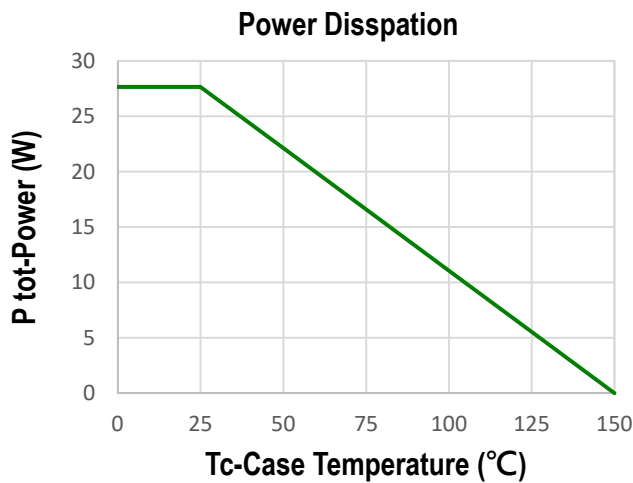


Fig. 10: Drain Current Vs. T_c

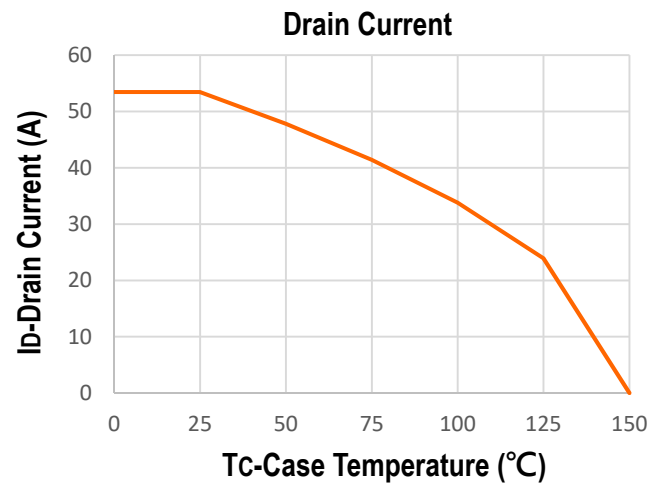


Fig. 11: Body Diode Forward Voltage Vs. I_s

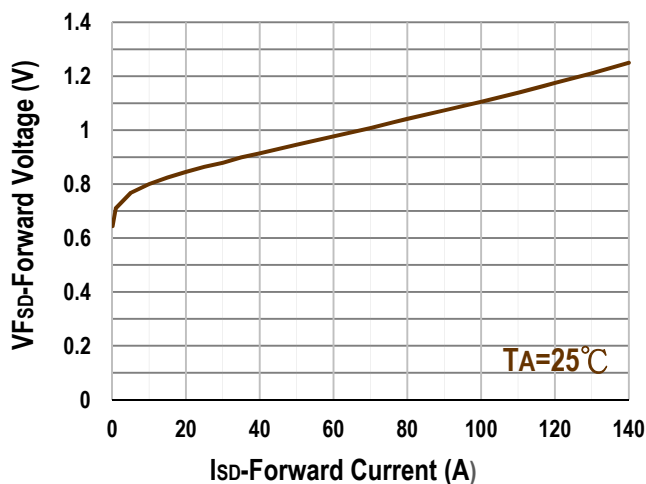
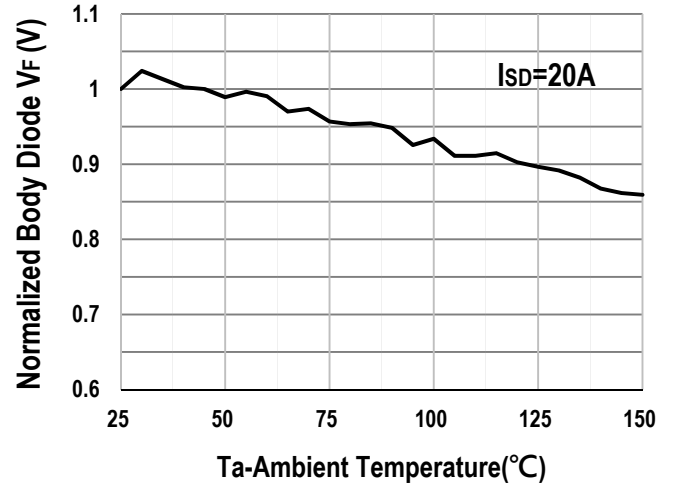


Fig. 12: Body Diode Forward Voltage Vs. T_A



Typical Operating Characteristics

Fig. 13: Safe Operation Area

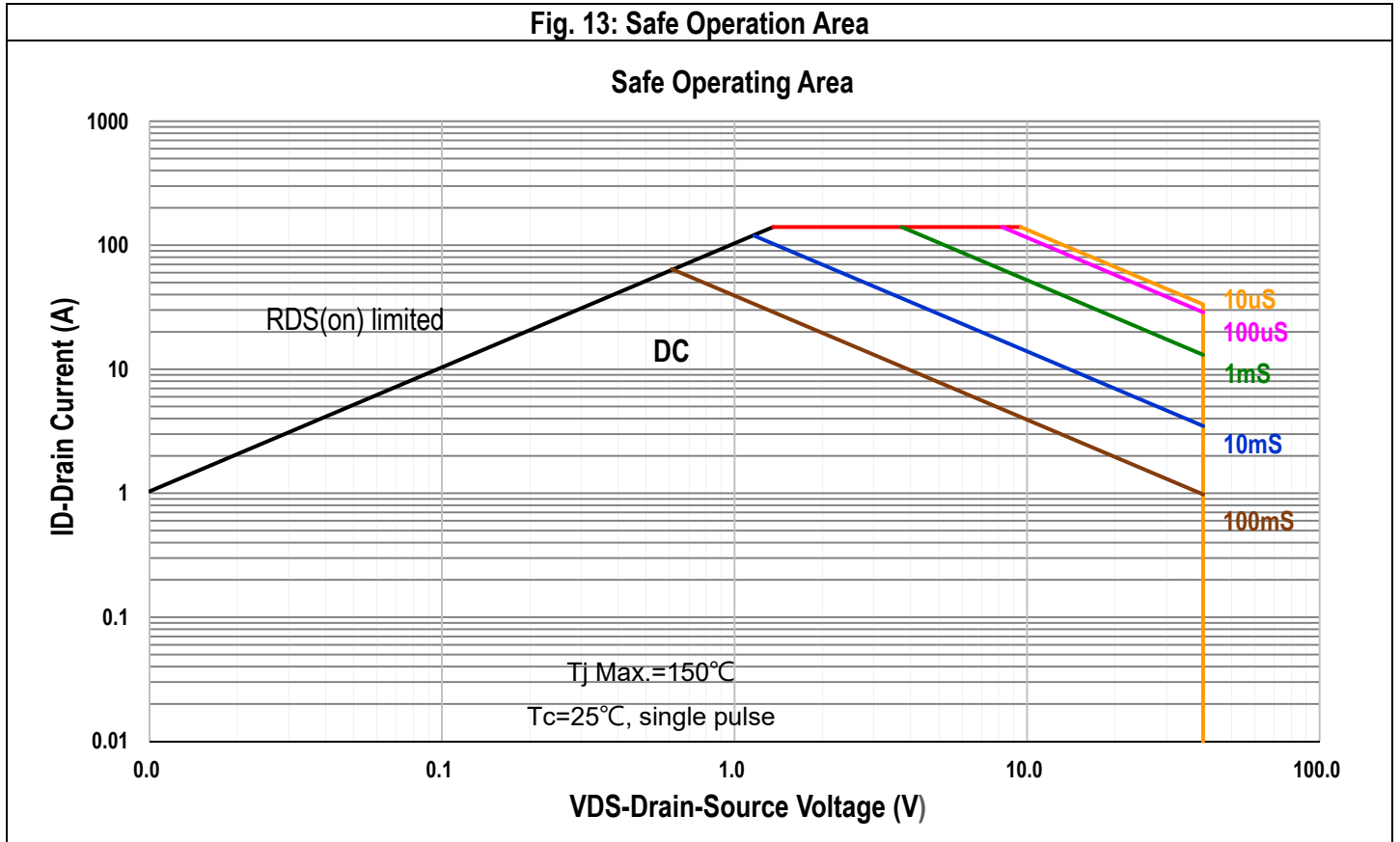
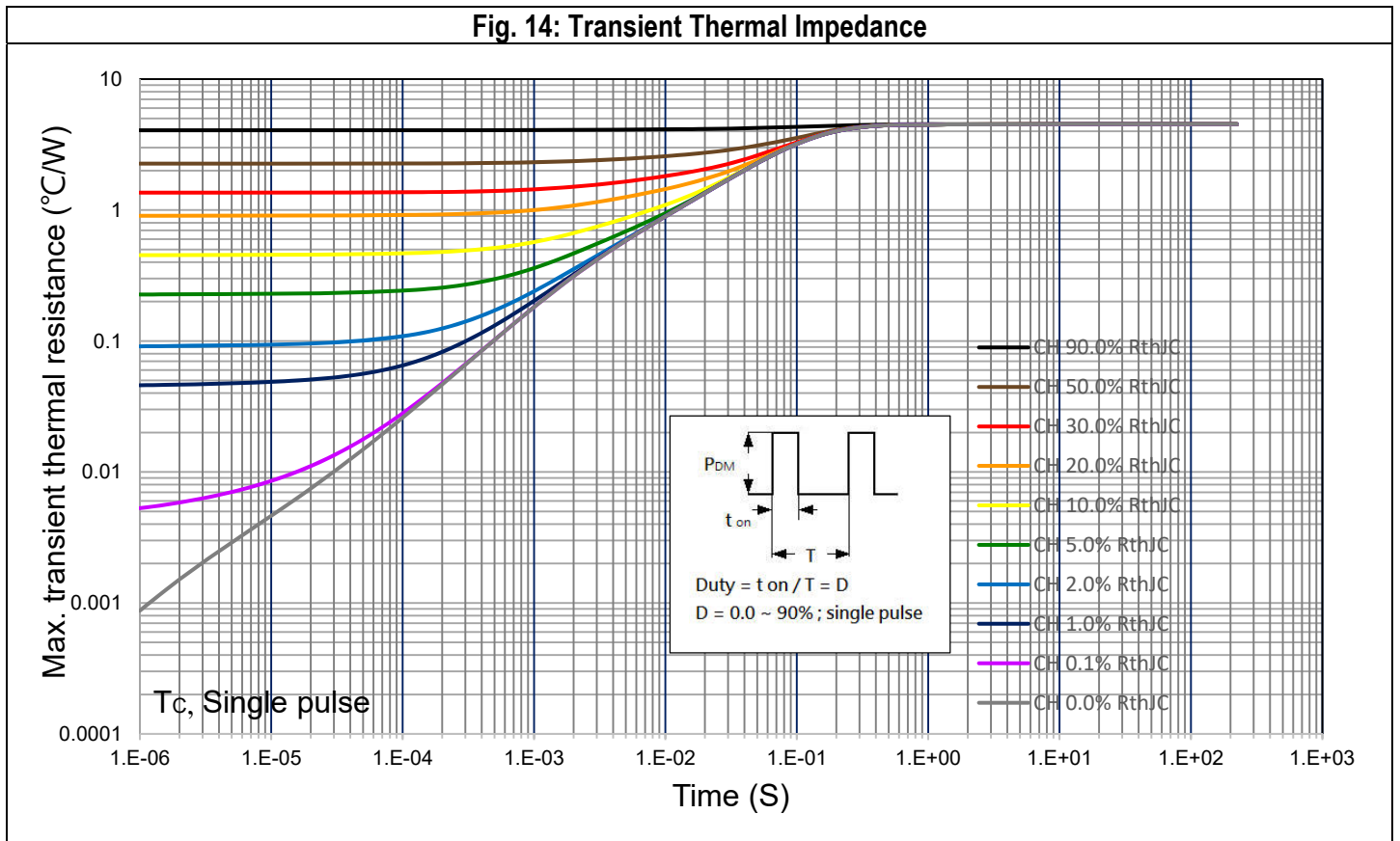
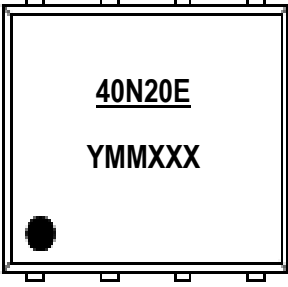


Fig. 14: Transient Thermal Impedance

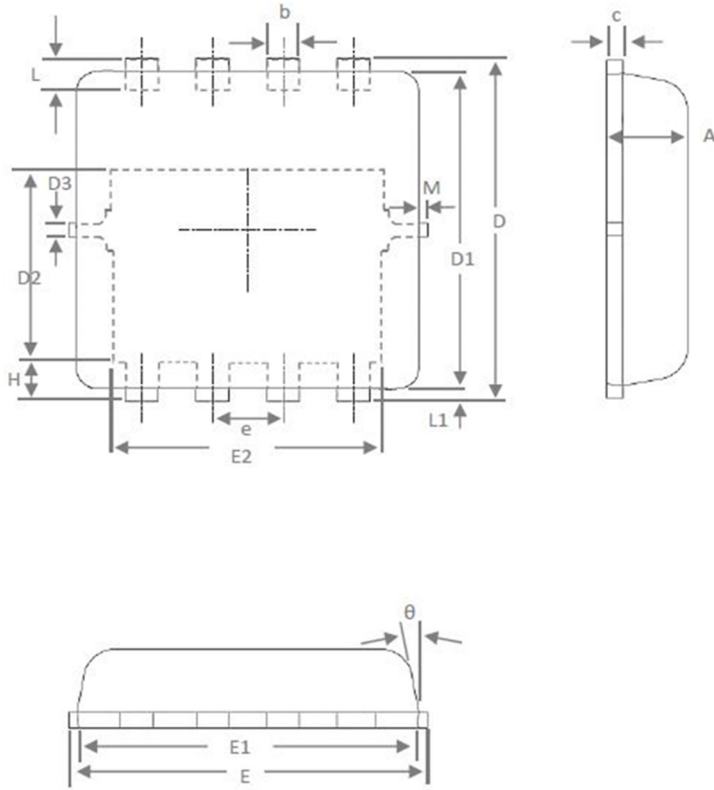


Marking Information

PDFN3.3x3.3-8L (E)	Marking Rule
<p>Laser Marking</p> 	<p><u>Line 1</u> : Device 40N20E</p> <p><u>Line 2</u> : Date Code YMMXXX</p> <p>Y : Year Code MM : Month Code XXX : Serial Number</p>

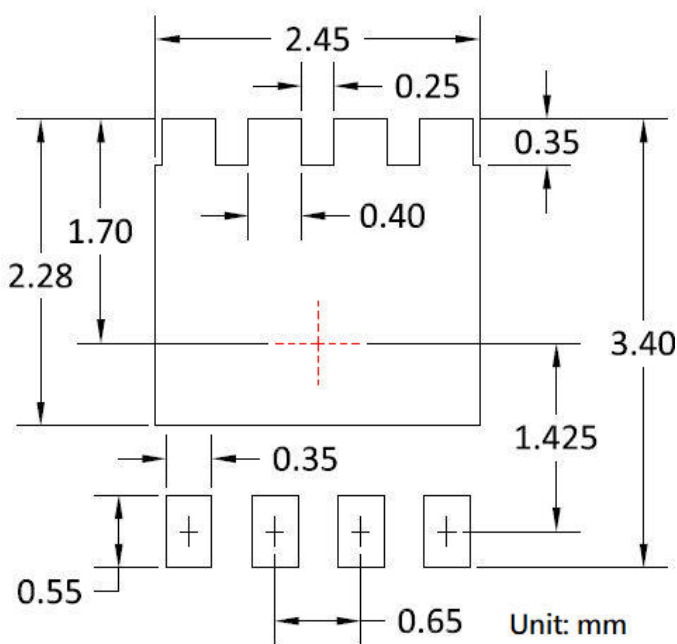
Package of Dimension

Package type: PDFN3.3x3.3-8L



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	-
θ	-	10°	12°
M	-	-	0.15

Land Pattern (Footprint)



Note 1: Land pattern (Footprint) design is for reference only.

Note 2: Package body sizes exclude mold flash and burrs.

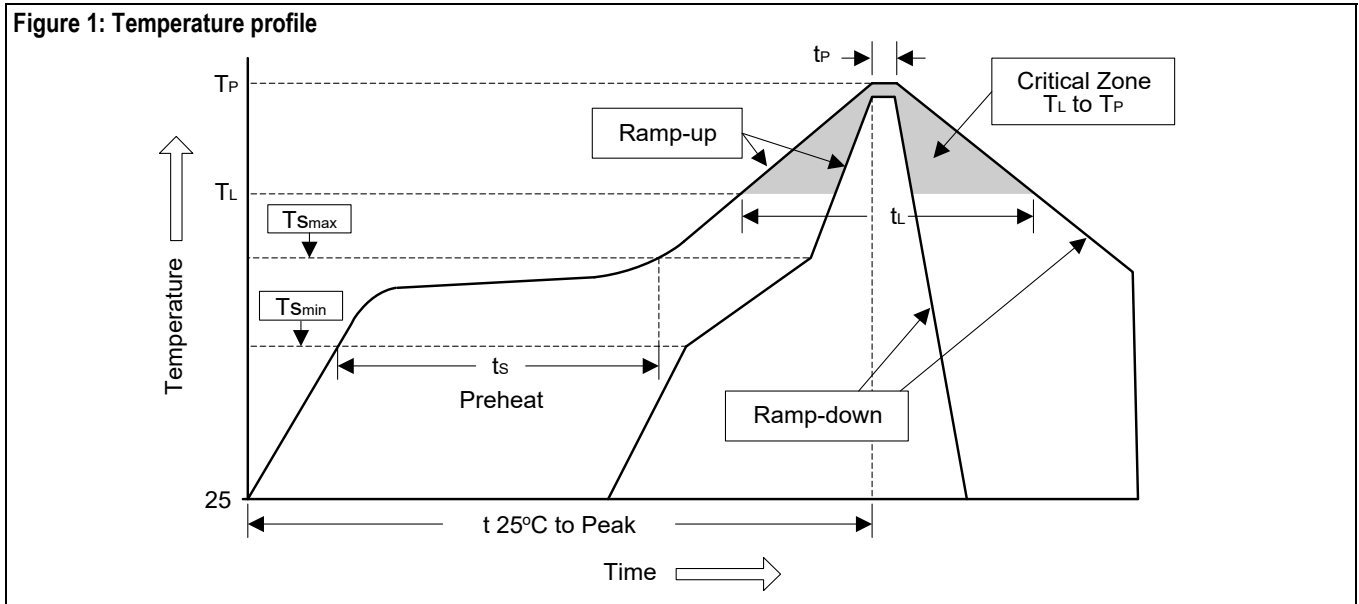
Note 3: Dimension is measured in gauge plane.

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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