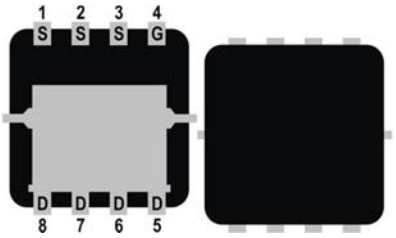
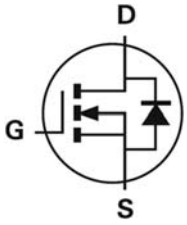
SG40N04E

40V N-Channel Power MOSFET

Parameter	Value	Unit
V_{DSS}	40	V
$R_{DS(ON)}$ max. V_{GS}=10V	11	mΩ
$R_{DS(ON)}$ max. V_{GS}=4.5V	16	mΩ
I_D	38	A

PDFN 3.3x3.3-8L





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
- DC-DC converters and Off-line UPS

Ordering Information

Ordering Code	RoHS Status	Package	Package Code	Packing	Quantity
SG40N04E	Halogen-Free	PDFN 3.3x3.3-8L	E	Tape & Reel	5,000

Absolute Maximum Ratings (T_A=25°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	T_C=25°C	I_D	38	A
	T_C=100°C		24	A
	T_A=25°C		10	A
	T_A=70°C		6	A
Drain Current-Pulsed Note 1		I_{DM}	100	A
Avalanche Current		I_{AS}	20	A
Avalanche Energy, L=0.1mH		E_{AS}	20	mJ
Maximum Power Dissipation	T_C=25°C	P_D	23.1	W
	T_C=100°C		9.3	W
	T_C=25°C		1.7	W
	T_C=70°C		0.7	W
Storage Temperature Range		T_{STG}	-55 to +150	°C
Operating Junction Temperature Range		T_J	-55 to +150	°C

Thermal Resistance Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Maximum Junction-to-Ambient	$R_{\theta JA}$	Steady State	-	-	75	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	Steady State	-	-	5.4	°C/W

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

OFF CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_{DS}=250μA	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=40V, V_{GS}=0V	-	-	1	μA
Gate-Body Leakage	I_{GSS}	V_{GS}=±20V, V_{DS}=0V	-	-	±100	nA

ON CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_{DS}=250μA	1	-	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_{DS}=9A	-	13	14.5	mΩ
Drain-Source On-State Resistance		V_{GS}=4.5V, I_{DS}=5A	-	17.5	20	mΩ
Forward Transconductance Note 1	g_{fs}	V_{DS}=5V, I_D=20A	-	35	-	S

DYNAMIC CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Input Capacitance	C_{iss}	V_{DS}=20V, V_{GS}=0V, f=1MHz	-	1248	-	pF
Output Capacitance	C_{oss}		-	114	-	
Reverse Transfer Capacitance	C_{rss}		-	84	-	
Gate Resistance	R_g	V_{GS}=0V, V_{DS}=0V, f=1MHz	-	2	-	Ω

SWITCHING CHARACTERISTICS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=20V, I_D=20A, V_{GS}=10V, Rg=3.3Ω	-	8.17	-	ns
Rise Time	t_r		-	3.23	-	
Turn-Off Delay Time	$T_{d(off)}$		-	23.75	-	
Fall Time	t_f		-	2.09	-	
Total Gate Charge	Q_g	V_{DS}=20V, I_{DS}=20A, V_{GS}=4.5V	-	10.16	-	nC
Gate to Source Gate Charge	Q_{gs}		-	3.13	-	
Gate to Drain “Miller” Charge	Q_{gd}		-	3.99	-	

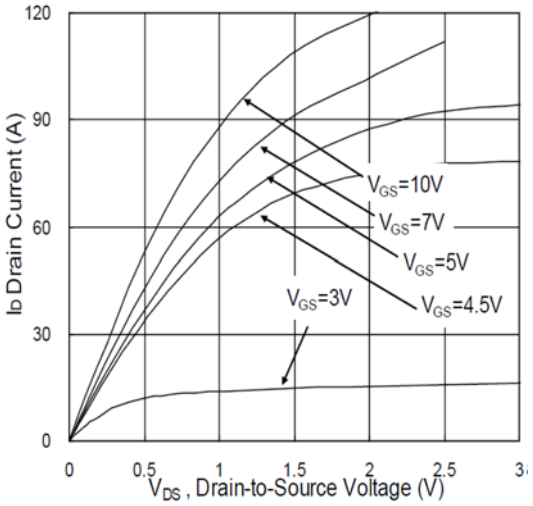
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Parameter	**Symbol**	**Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Maximum Body-Diode Continuous Current	I_S	V_G=V_D=0V, Force Current	-	-	38	A
Pulsed Source Current	I_{SM}	V_G=V_D=0V, Force Current	-	-	100	A
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=20A	-	-	1.2	V

Notes:

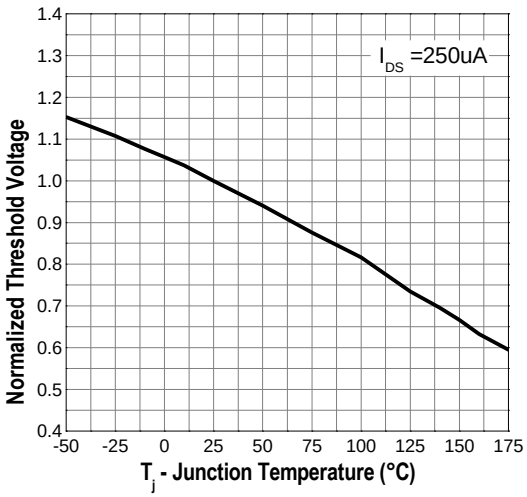
1. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
2. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta JA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 in still air.

Typical Operating Characteristics

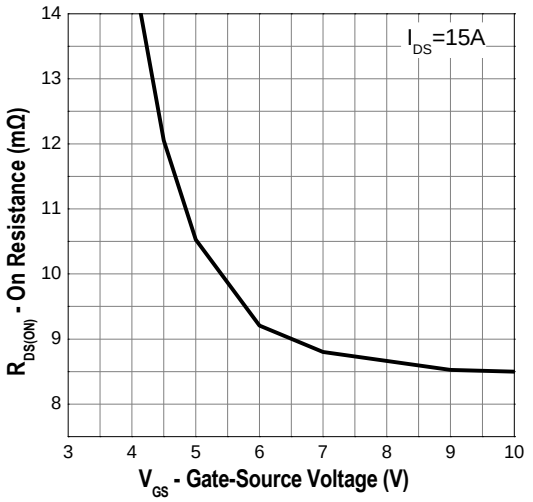
Output Characteristics



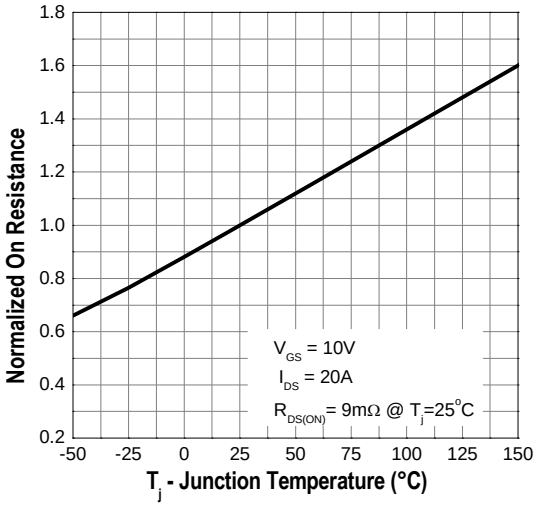
Gate Threshold Voltage



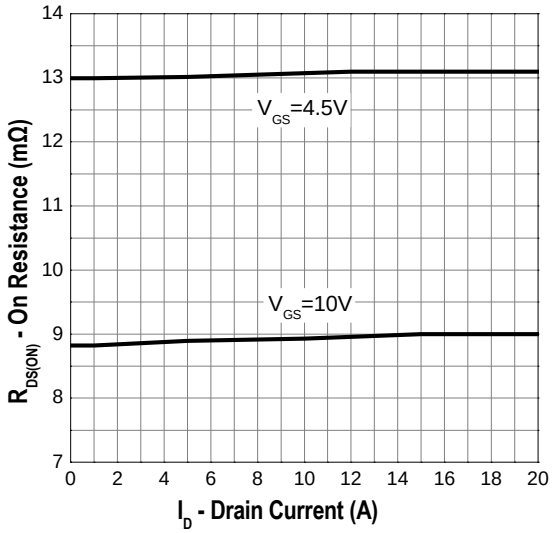
Gate-Source On Resistance



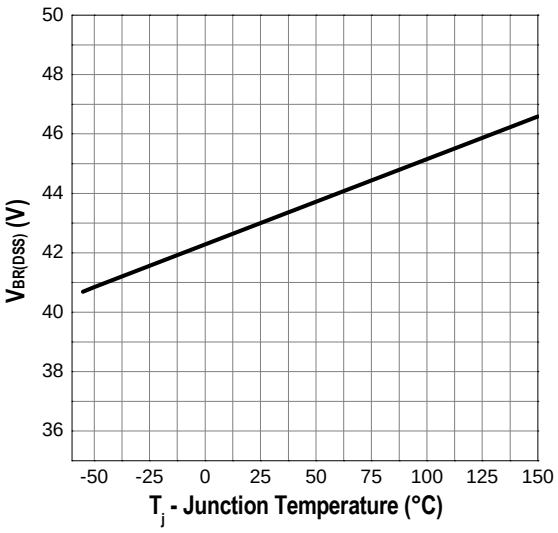
Drain-Source On Resistance



Drain-Source On Resistance

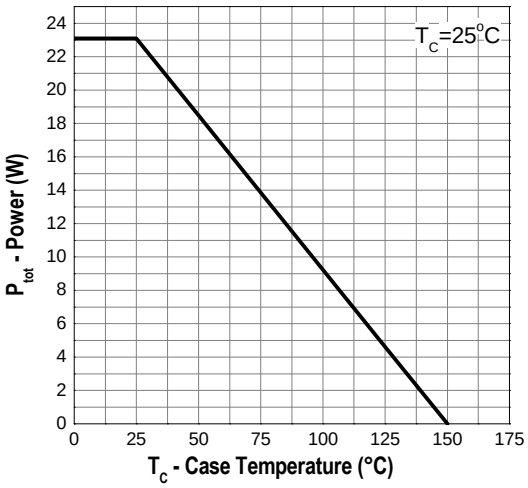


Drain-source Breakdown Voltage

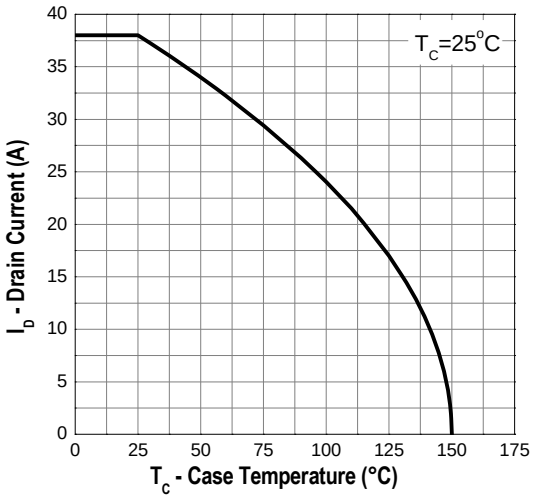


Typical Operating Characteristics (Cont.)

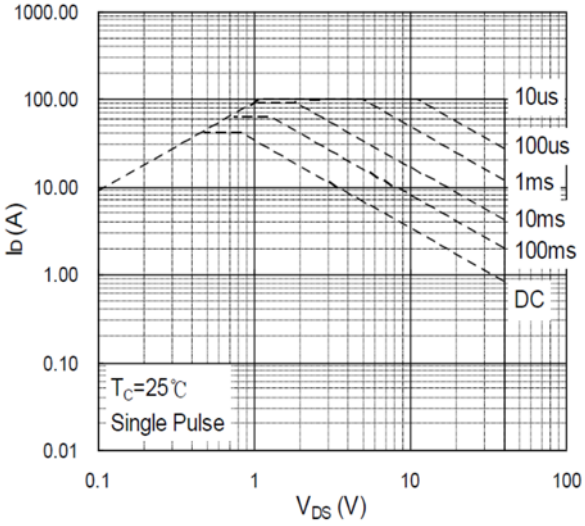
Power Dissipation



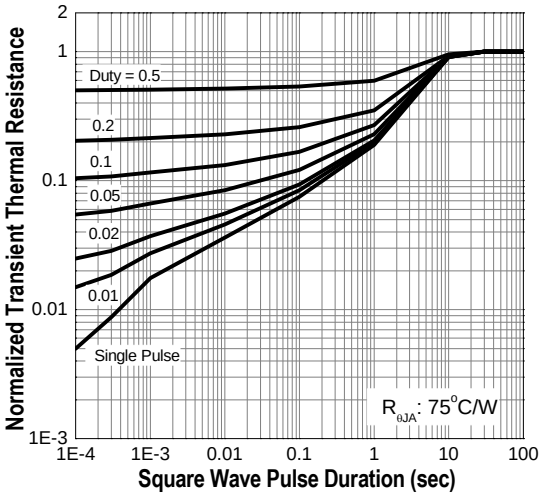
Drain Current



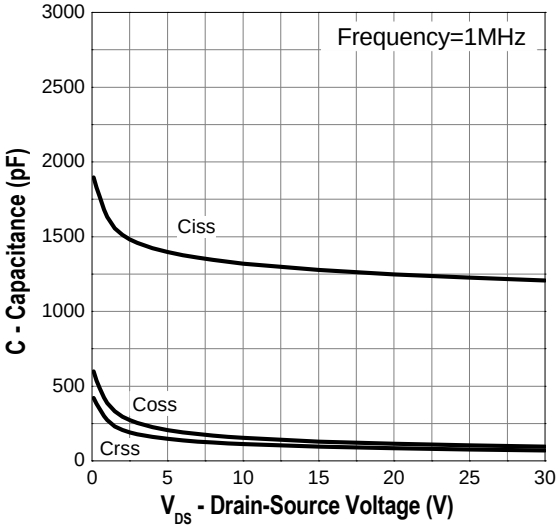
Safe Operation Area



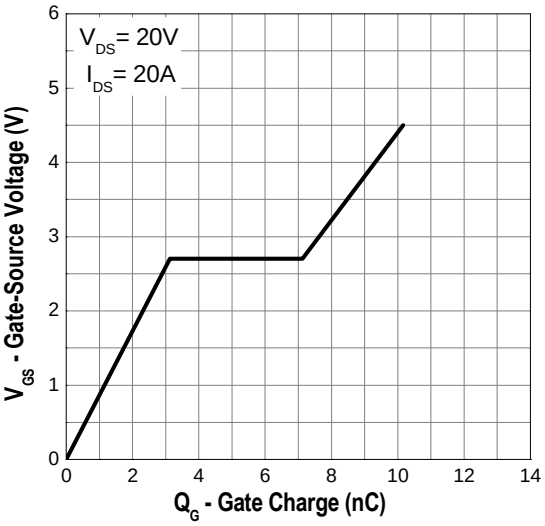
Transient Thermal Impedance



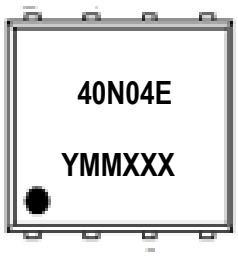
Capacitance



Gate Charge



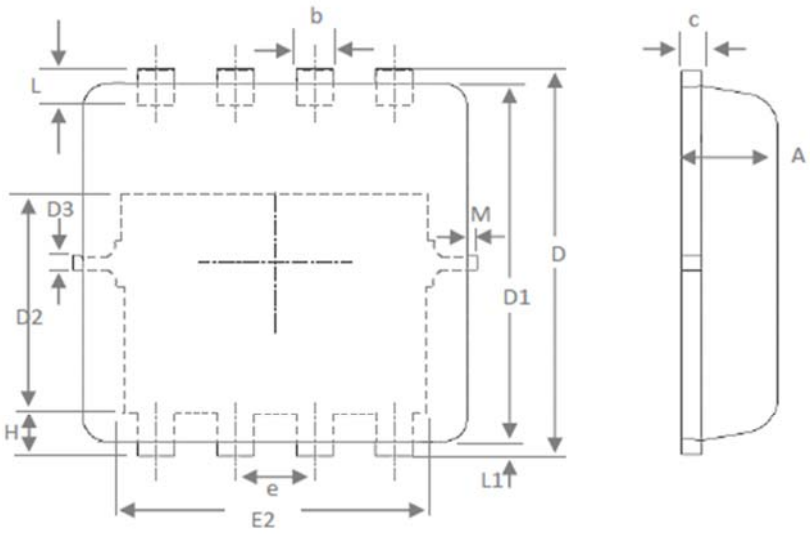
Marking Information

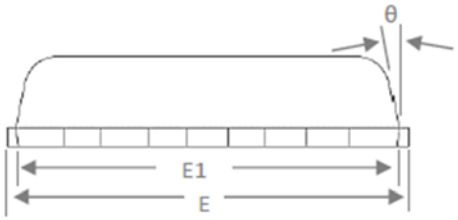
PDFN 3.3x3.3-8L (E)	Marking Rule
Laser Marking  	Line 1：Device 40N04E Line 2：Date Code YMMXXX Y：Year Code MM：Month Code XXX：Serial Number Year Code Description As Below

Year Code Description

Year Code	Year	
0	2010	2020
1	2011	2021
2	2012	2022
3	2013	2023
4	2014	2024
5	2015	2025
6	2016	2026
7	2017	2027
8	2018	2028
9	2019	2029

Package of Dimension



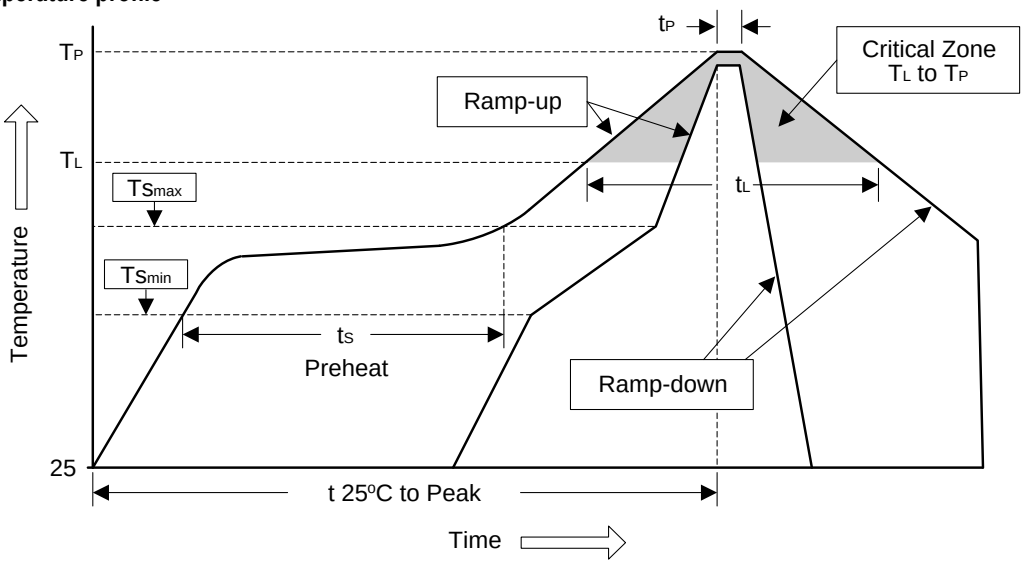


Symbol	Min	Nor	Max
A	0.70	0.75	0.80
b	0.25	0.30	0.35
c	0.10	0.15	0.25
D	3.25	3.35	3.45
D1	3.00	3.10	3.20
D2	1.48	1.58	1.68
D3	-	0.13	-
E	3.00	3.30	3.40
E1	3.00	3.15	3.20
E2	2.39	2.49	2.59
e		0.65BSC	
H	0.30	0.39	0.50
L	0.30	0.40	0.50
L1	-	0.13	-
θ	-	10°	12°
M	-	-	0.15

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

Important Notice