N+P Channel Advanced Power MOSFET

TF20NP03N

General Description

The TF20NP03N combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. It combines one N Channel MOSFET and one P channel MOSFET.

Features

Advance high cell density Trench technology

Low $R_{DS(ON)}$ to minimize conductive loss

Low Gate Charge for fast switching

Dual DIE in one package

Application

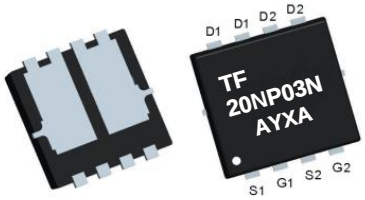
Power Management in Notebook Computer

BLDC Motor driver

Product Summary

N-channel P-channel

RoHS compliant



PDFN5060-8L

Part NO.	TF20NP03N
Marking1	20NP03N:TF20NP03N
Marking2	TF:tuofeng; AA:device code; Y:year code; X:Week
Basic ordering unit (pcs)	5000

V_{DS}	30	-30	V
$R_{DS(on)}$, TYP V_{GS}=±10 V	15	19	mΩ
$R_{DS(on)}$, TYP V_{GS}=±4.5V	20	25	mΩ
I_D	20	-21	A

Maximum ratings, at T_A =25°C, unless otherwise specified

Symbol	Parameter		Rating		Unit
			NMOS	PMOS	
$V_{(BR)DSS}$	Drain-Source breakdown voltage		30	-30	V
V_{GS}	Gate-Source voltage		±20	±20	V
I_S	Diode continuous forward current	T_C =25°C	20	-21	A
I_D	Continuous drain current @VGS=±10V	T_C =25°C	20	-21	A
		T_C =100°C	14	-15	A
I_{DM}	Pulse drain current tested ①	T_C =25°C	60	-63	A
I_{DSM}	Continuous drain current @VGS=±10V	T_A=25°C	11	-12	A
		T_A=70°C	9	-10	A
EAS	Avalanche energy, single pulsed ②		19	42	mJ
P_D	Maximum power dissipation	T_C =25°C	15	18	W
P_{DSM}	Maximum power dissipation ③	T_A=25°C	2.0	2.0	W
T_{STG}, T_J	Storage and junction temperature range		-55 to 150	-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Typical		Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	9.1	10.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	52		°C/W

N-Channel Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ T_J = 25°C (unless otherwise stated)						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	30	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current(T_j=25℃)	V_{DS}=30V,V_{GS}=0V	--	--	1	μA
	Zero Gate Voltage Drain Current(T_j=125℃)	V_{DS}=30V,V_{GS}=0V	--	--	100	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V,V_{DS}=0V	--	--	±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=250μA	1.1	1.5	2.1	V
$R_{DS(ON)}$	Drain-Source On-State Resistance ④	V_{GS}=10V, I_D=8A	--	15	19	mΩ
		V_{GS}=4.5V, I_D=6A	--	20	25	mΩ
Dynamic Electrical Characteristics @ T_J= 25°C (unless otherwise stated)						
C_{iss}	Input Capacitance	V_{DS}=15V,V_{GS}=0V, f=1MHz	--	525.9	--	pF
C_{oss}	Output Capacitance		--	53.5	--	pF
C_{rss}	Reverse Transfer Capacitance		--	41.5	--	pF
R_g	Gate Resistance	f=1MHz	--	6.0	--	Ω
Q_g	Total Gate Charge	V_{DS}=15V,I_D=8A, V_{GS}=10V	--	11.8	--	nC
Q_{gs}	Gate Source Charge		--	2.45	--	nC
Q_{gd}	Gate Drain Charge		--	1.45	--	nC
Switching Characteristics						
$t_{d(on)}$	Turn on Delay Time	V_{DD}=15V, I_D=8A, R_G=6Ω, V_{GS}=10V	--	4.18	--	ns
t_r	Turn on Rise Time		--	29.6	--	ns
$t_{d(off)}$	Turn Off Delay Time		-	15.5	--	ns
t_f	Turn Off Fall Time		--	5.67	--	ns
Source Drain Diode Characteristics						
V_{SD}	Forward on voltage	I_{SD}=8A,V_{GS}=0V	--	0.85	1.2	V
t_{rr}	Reverse Recovery Time	T_j=25℃,I_{sd}=8A, V_{GS}=0V di/dt=100A/μs	--	8.3	--	ns
Q_{rr}	Reverse Recovery Charge		--	10.2	--	nC

NOTE: ① Repetitive rating; pulse width limited by max. junction temperature.
② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.5mH, R_G = 25Ω, I_{AS} = 6A, V_{GS} =10V. Part not recommended for use above this value
③ The power dissipation P_{DSM} is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C.
④ Pulse width ≤ 300μs; duty cycle≤ 2%.

P-Channel Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ T_J = 25°C (unless otherwise stated)						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=-250μA	-30	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current(T_j=25℃)	V_{DS}=-30V,V_{GS}=0V	--	--	-1	μA
	Zero Gate Voltage Drain Current(T_j=125℃)	V_{DS}=-30V,V_{GS}=0V	--	--	-100	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V,V_{DS}=0V	--	--	±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=-250μA	-1.1	-1.5	-2.1	V
$R_{DS(ON)}$	Drain-Source On-State Resistance ④	V_{GS}=-10V, I_D=-8A	--	19	24	mΩ
		V_{GS}=-4.5V, I_D=-6A	--	25	30	mΩ
Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise stated)						
C_{iss}	Input Capacitance	VDS=-15V,VGS=0V, f=1MHz	--	905	--	pF
C_{oss}	Output Capacitance		--	90.3	--	pF
C_{rss}	Reverse Transfer Capacitance		--	94.7	--	pF
R_g	Gate Resistance	f=1MHz	--	6.0	--	Ω
Q_g	Total Gate Charge	VDS=-15V,ID=-8A, VGS=-10V	--	22.2	--	nC
Q_{gs}	Gate Source Charge		--	3.25	--	nC
Q_{gd}	Gate Drain Charge		--	3.65	--	nC
Switching Characteristics						
$t_{d(on)}$	Turn on Delay Time	VDD=-15V, ID=-8A, RG=6Ω, VGS=-10V	--	6.4	--	ns
t_r	Turn on Rise Time		--	29.5	--	ns
$t_{d(off)}$	Turn Off Delay Time		-	47.9	--	ns
t_f	Turn Off Fall Time		--	30.5	--	ns
Source Drain Diode Characteristics						
V_{SD}	Forward on voltage	I_{SD}=-8A,V_{GS}=0V	--	-0.86	-1.2	V
t_{rr}	Reverse Recovery Time	T_j=25℃,Isd=-8A, VGS=0V di/dt=-100A/μs	--	10.7	--	ns
Q_{rr}	Reverse Recovery Charge		--	9.6	--	nC

NOTE: ① Repetitive rating; pulse width limited by max. junction temperature.
② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.5mH, R_G = 25Ω, I_{AS} = -12A, V_{GS} =-10V. Part not recommended for use above this value
③ The power dissipation P_{DSM} is based on $R_{\theta JA}$ and the maximum allowed junction temperature of 150°C.
④ Pulse width ≤ 300μs; duty cycle≤ 2%.

N-Channel Typical Characteristics

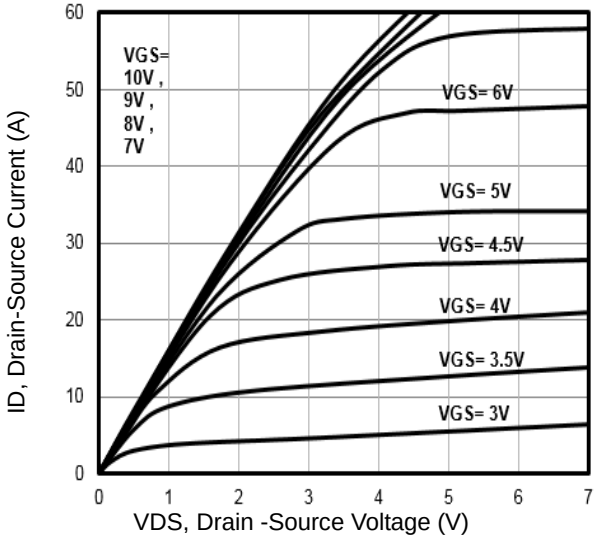


Fig1. Typical Output Characteristics

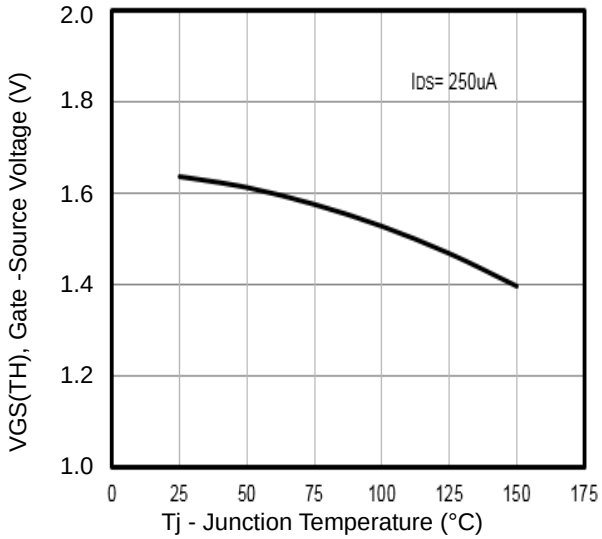


Fig2. $V_{GS(TH)}$ Gate -Source Voltage Vs. Tj

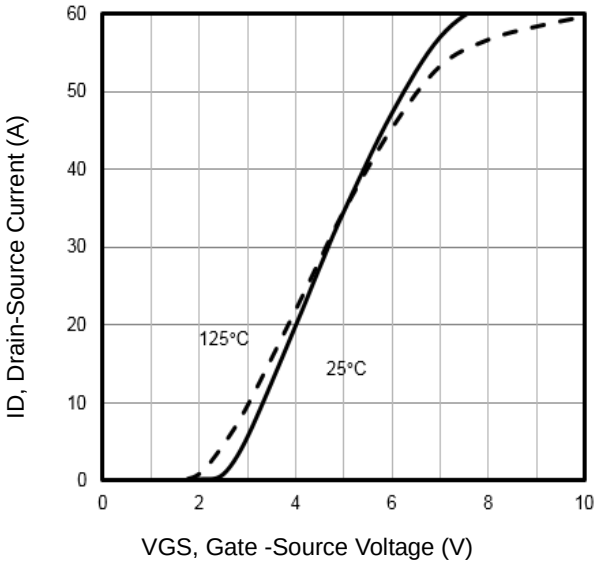


Fig3. Typical Transfer Characteristics

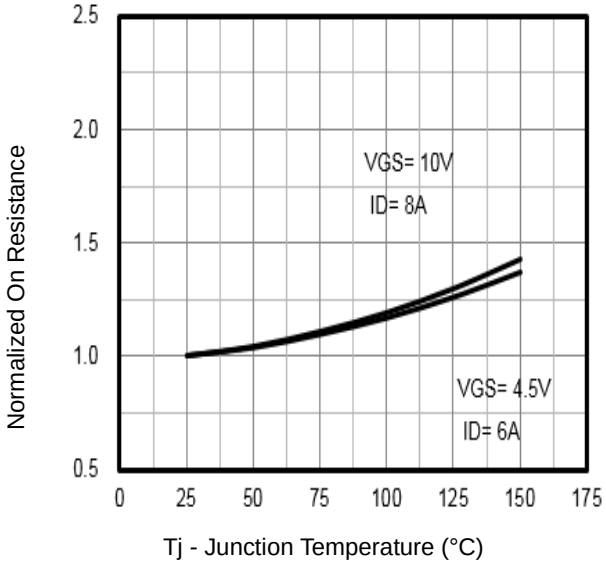


Fig4. Normalized On-Resistance Vs. Tj

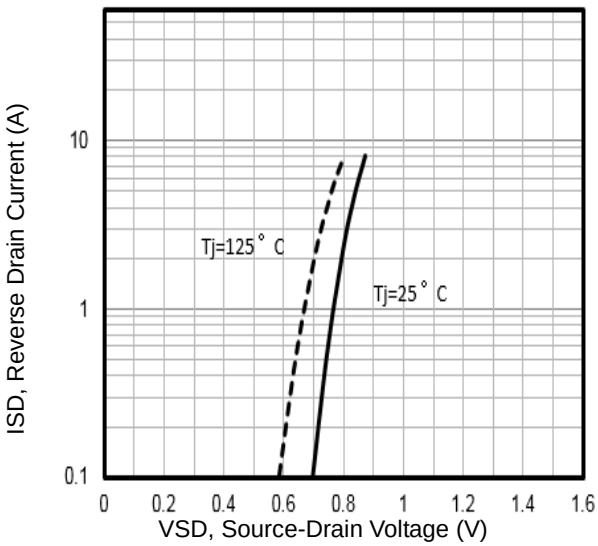


Fig5. Typical Source-Drain Diode Forward Voltage

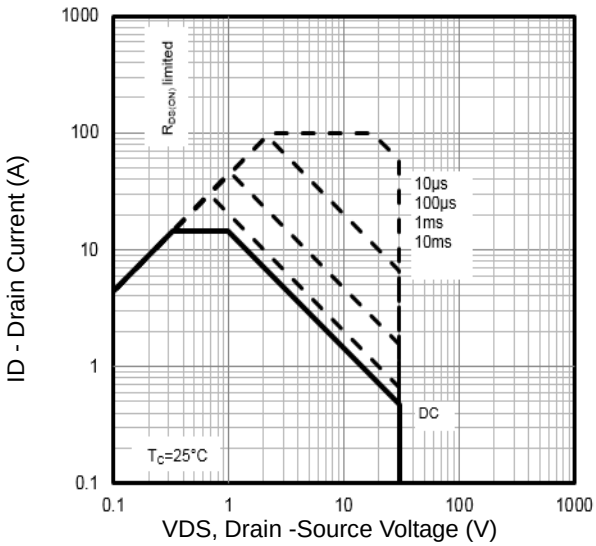


Fig6. Maximum Safe Operating Area

N-Channel Typical Characteristics

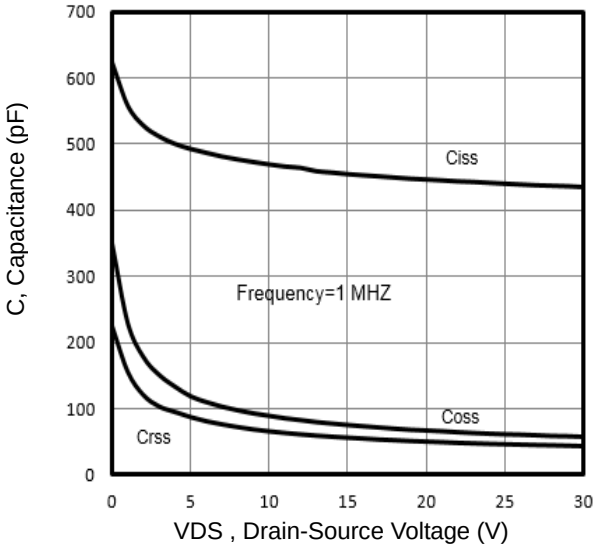


Fig7. Typical Capacitance Vs.Drain-Source Voltage

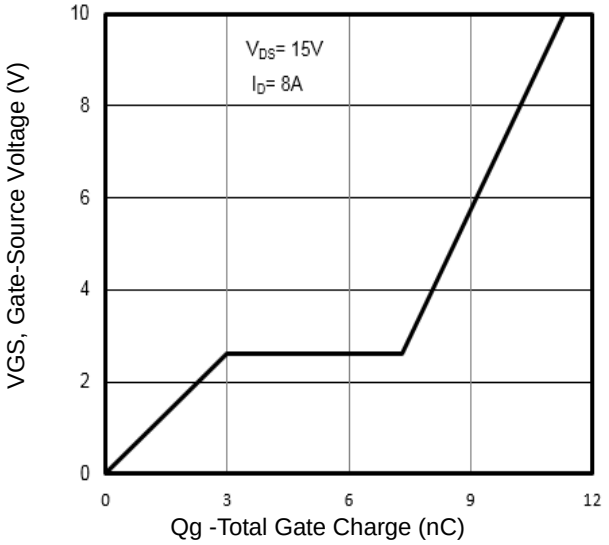


Fig8. Typical Gate Charge Vs.Gate-Source Voltage

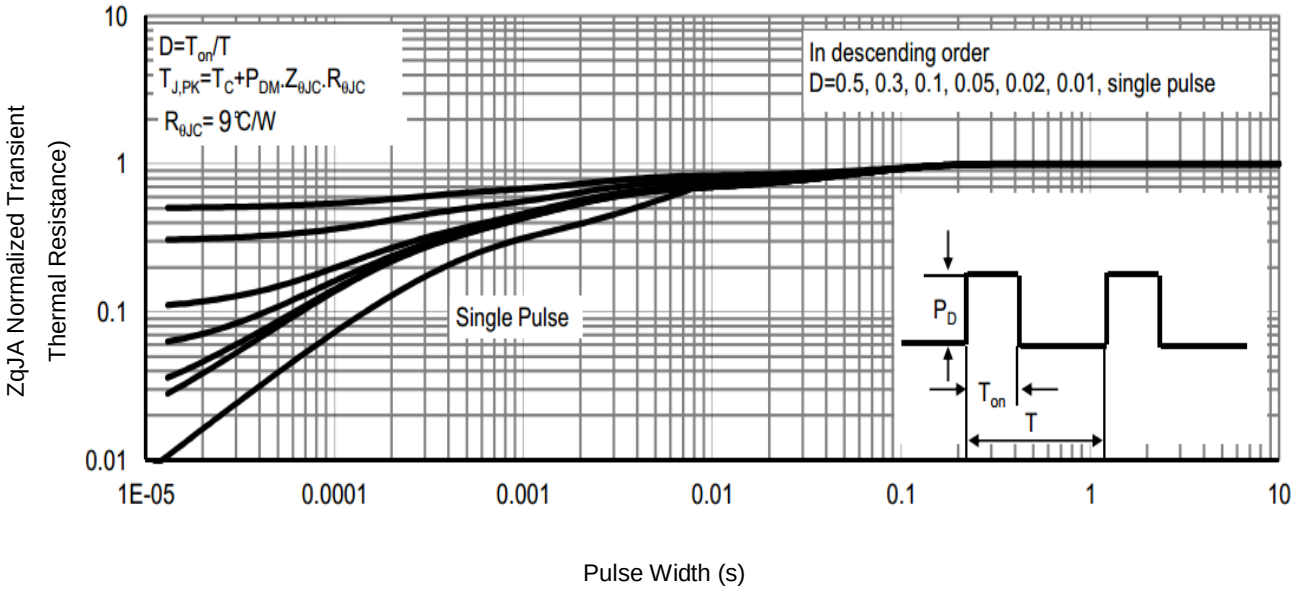


Fig 9 .Normalized Maximum Transient Thermal Impedance

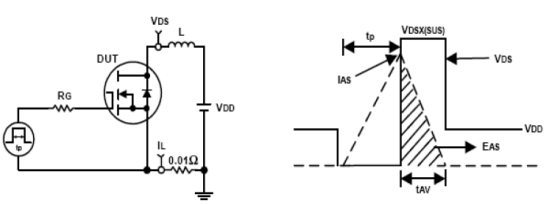


Fig10. Unclamped Inductive Test Circuit and waveforms

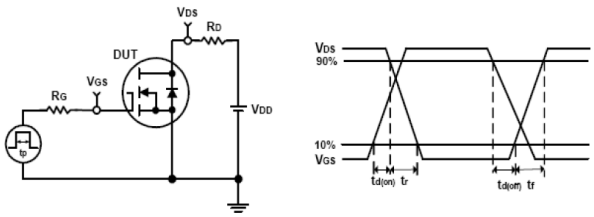


Fig11. Switching Time Test Circuit and waveforms

P-Channel Typical Characteristics

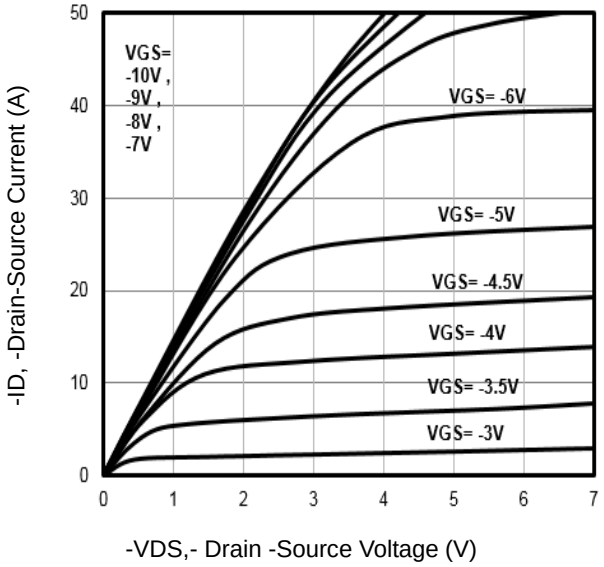


Fig1. Typical Output Characteristics

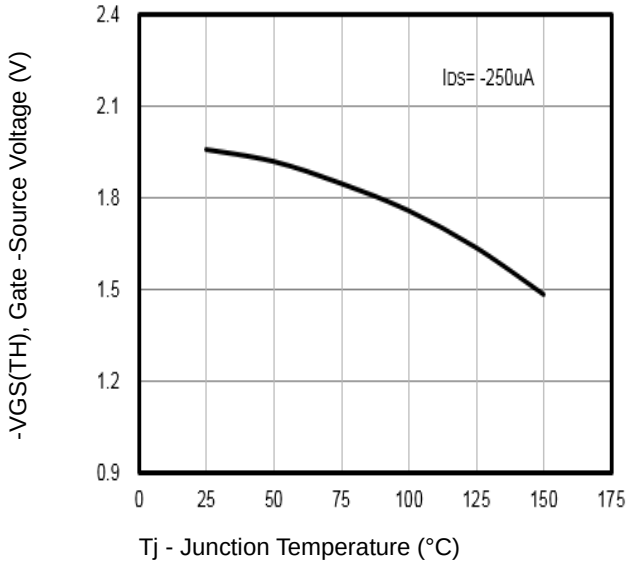


Fig2. $-V_{GS(TH)}$ Gate -Source Voltage Vs. Tj

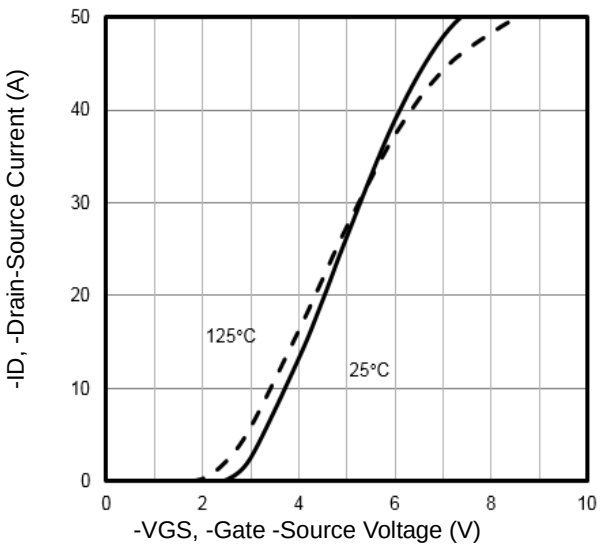


Fig3. Typical Transfer Characteristics

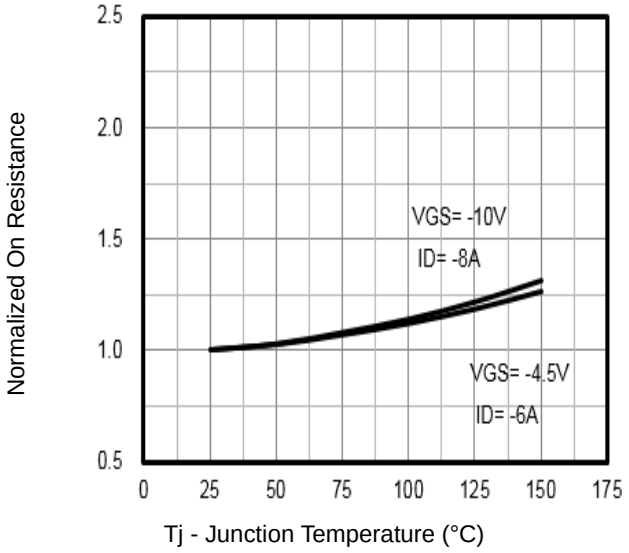


Fig4. Normalized On-Resistance Vs. Tj

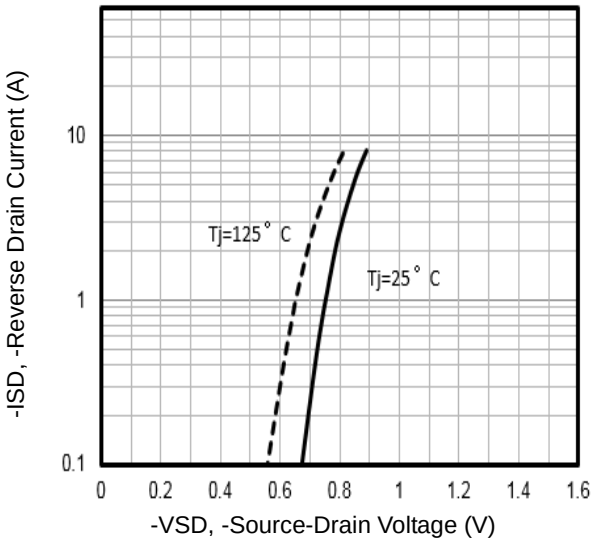


Fig5. Typical Source-Drain Diode Forward Voltage

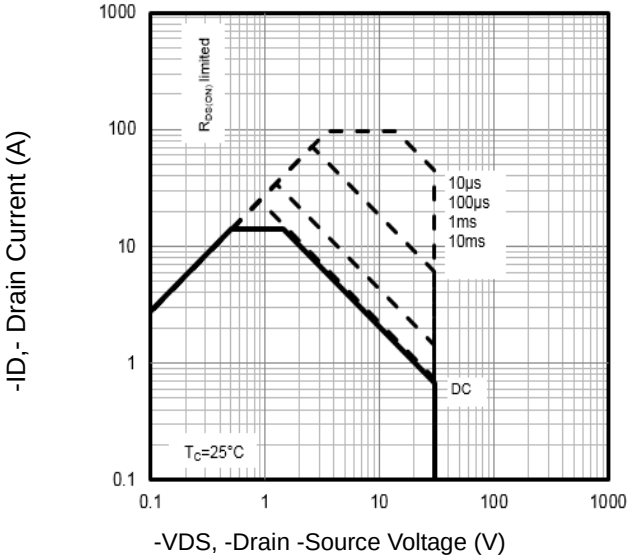


Fig6. Maximum Safe Operating Area

P-Channel Typical Characteristics

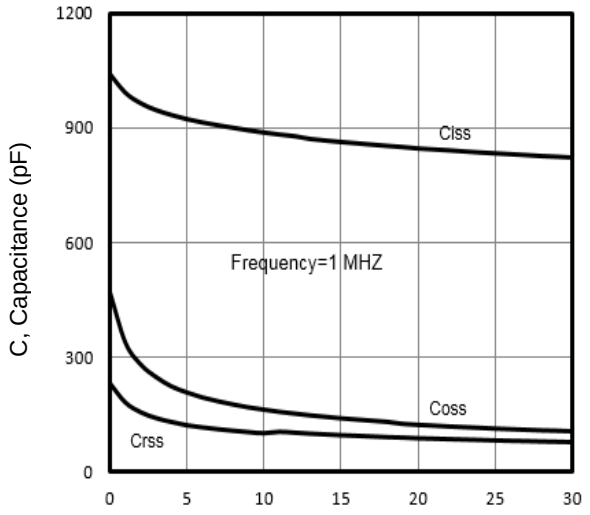


Fig7. Typical Capacitance Vs.Drain-Source Voltage

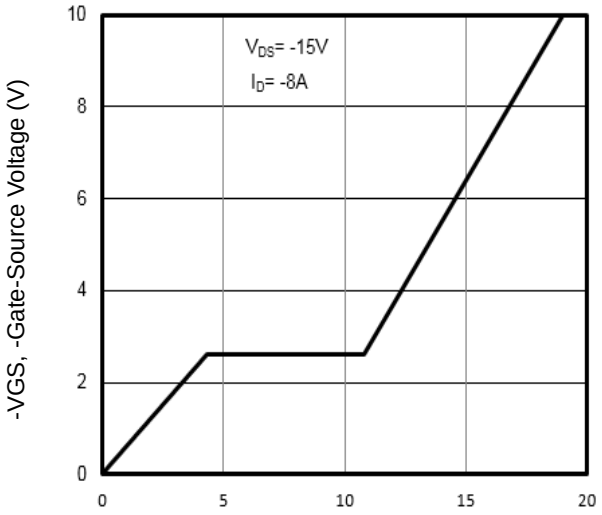


Fig8. Typical Gate Charge Vs.Gate-Source Voltage

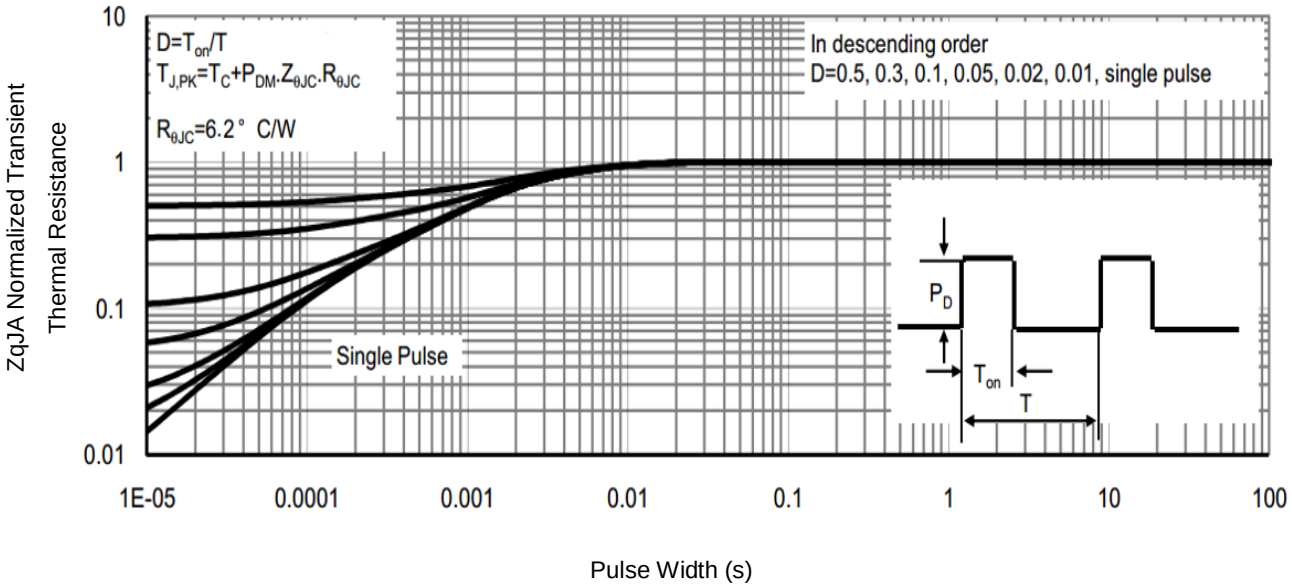


Fig9. Normalized Maximum Transient Thermal Impedance

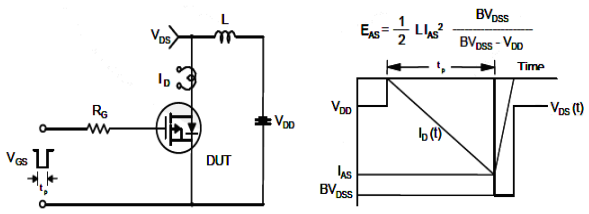


Fig10. Unclamped Inductive Test Circuit and Waveforms

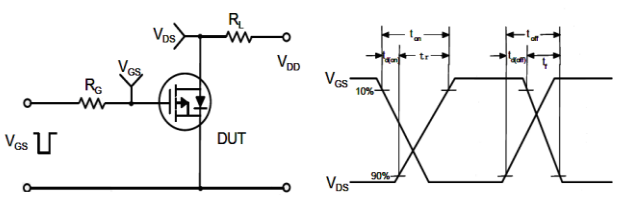
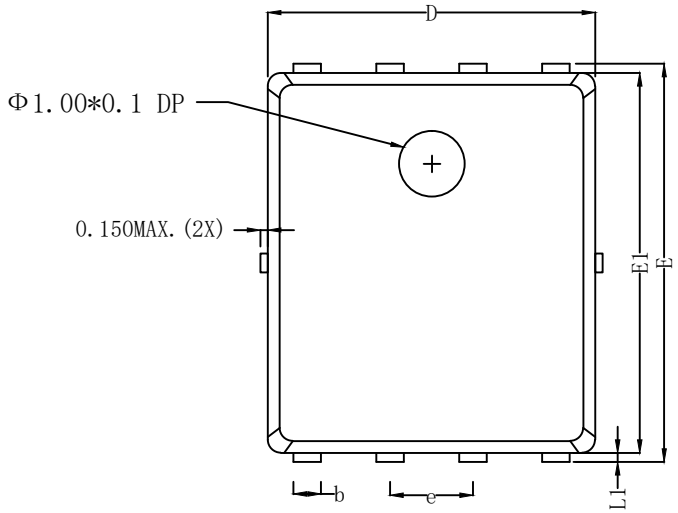
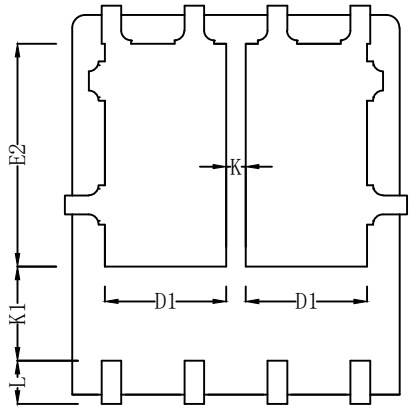
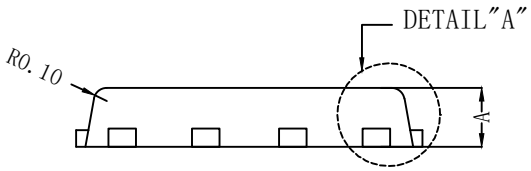


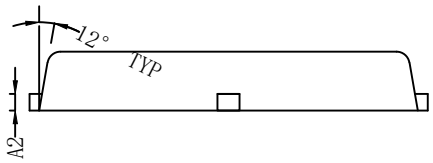
Fig11. Switching Time Test Circuit and waveforms

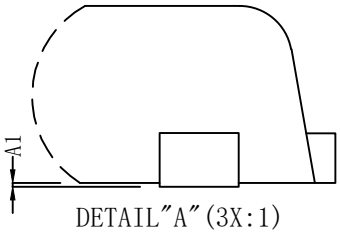
Dual PDFN5060-8L Package Outline Data











DimensionsInMillimeterer			
Symbol	MIN	TYP	MAX
A	0.90	1.00	1.10
A1	0.00	0.03	0.05
A2		0.254REF	
b	0.25	0.30	0.35
D	4.80	4.90	5.00
D1	1.60	1.70	1.80
E	5.90	6.00	6.10
E1	5.65	5.75	5.85
E2	3.38	3.48	3.58
e		1.27BSC	
K	0.55	0.60	0.65
K1		1.35REF	
L	0.55	0.60	0.65
L1	0.10	0.13	0.16