

General Description

The TF20NP02M 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.

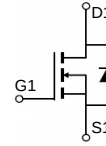
Features

- 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

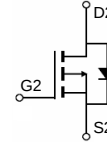
Application

- Power Management in Notebook Computer
- BLDC Motor driver

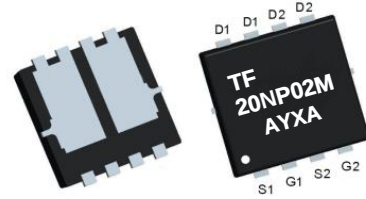
Product Summary



N-channel



P-channel



PDFN3333-8L

Part NO.	TF20NP02M
Marking1	20NP02M: TF20NP02M
Marking2	TF:tuofeng; AA:device code; Y:year code; X:week code
Basic ordering unit (pcs)	5000

V_{DS}	20	-20	V
$R_{DS(on)}, TYP$ $V_{GS}=\pm 4.5V$	11	21	mΩ
$R_{DS(on)}, TYP$ $V_{GS}=\pm 2.5V$	15	27	mΩ
I_D	20	-19	A

Maximum ratings, at $T_A = 25^\circ C$, unless otherwise specified

Symbol	Parameter		Rating		Unit
			NMOS	PMOS	
V _{(BR)DSS}	Drain-Source breakdown voltage		20	-20	V
V _{GS}	Gate-Source voltage		±12	±12	V
I _S	Diode continuous forward current	T _C =25°C	20	-19	A
I _D	Continuous drain current @V _{GS} = ±10V	T _C =25°C	20	-19	A
		T _C =70°C	12	-11	A
I _{DM}	Pulse drain current tested ①	T _C =25°C	60	-54	A
EAS	Avalanche energy, single pulsed ②		25	20	mJ
P _D	Maximum power dissipation	T _C =25°C	12	11	W
P _{DSM}	Maximum power dissipation ③	T _A =25°C	1.0	1.0	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	7.0	9.5	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	60		$^\circ C/W$

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	20	--	--	V
I _{DSS}	Zero Gate Voltage Drain Current(T _J =25°C)	V _{DS} =20V,V _{GS} =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(T _J =125°C)	V _{DS} =20V,V _{GS} =0V	--	--	100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±12V,V _{DS} =0V	--	--	±100	nA
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} =V _{GS} ,I _D =250μA	0.5	0.7	1.0	V
R _{DS(ON)}	Drain-Source On-State Resistance ④	V _{GS} =4.5V, I _D =7.5A	--	11	22	mΩ
		V _{GS} =2.5V, I _D =4.0A	--	15	33	mΩ
Dynamic Electrical Characteristics @ T _J = 25°C (unless otherwise stated)						
C _{iss}	Input Capacitance	V _{DS} =10V,V _{GS} =0V, f=1MHz	--	742	--	pF
C _{oss}	Output Capacitance		--	66.0	--	pF
C _{rss}	Reverse Transfer Capacitance		--	78.0	--	pF
R _g	Gate Resistance	f=1MHz	--	1.3	--	Ω
Q _g	Total Gate Charge	V _{DS} =10V,I _D =7.5A, V _{GS} =4.5V	--	9.0	--	nC
Q _{gs}	Gate Source Charge		--	1.5	--	nC
Q _{gd}	Gate Drain Charge		--	2.6	--	nC
Switching Characteristics						
t _{d(on)}	Turn on Delay Time	V _{DD} =10V, I _D =7.5A, R _G =3Ω, V _{GS} =4.5V	--	12.0	--	ns
t _r	Turn on Rise Time		--	23.0	--	ns
t _{d(off)}	Turn Off Delay Time		-	14.0	--	ns
t _f	Turn Off Fall Time		--	9.00	--	ns
Source Drain Diode Characteristics						
V _{SD}	Forward on voltage	I _{SD} =5.0A,V _{GS} =0V	--	0.77	1.0	V
t _{rr}	Reverse Recovery Time	T _J =25°C ,I _{sd} =5.0A, V _{GS} =0V di/dt=10A/μs	--	7.80	--	ns
Q _{rr}	Reverse Recovery Charge		--	9.90	--	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} = 7A, V_{GS} = 4.5V. Part not recommended for use above this value

③ The power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150°C.

④ Pulse width ≤ 300μs; duty cycles ≤ 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	-20	--	--	V
I _{DSS}	Zero Gate Voltage Drain Current(T _J =25°C)	V _{DS} =-20V,V _{GS} =0V	--	--	-1	μA
	Zero Gate Voltage Drain Current(T _J =125°C)	V _{DS} =-20V,V _{GS} =0V	--	--	-100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±12V,V _{DS} =0V	--	--	±100	nA
V _{GS(TH)}	Gate Threshold Voltage	V _{DS} =V _{GS} ,I _D =-250μA	-0.5	-0.7	-1.0	V
R _{DS(ON)}	Drain-Source On-State Resistance ④	V _{GS} =-4.5V, I _D =-4.5A	--	21	30	mΩ
		V _{GS} =-2.5V, I _D =-3.0A	--	27	40	mΩ
Dynamic Electrical Characteristics @ T _J = 25°C (unless otherwise stated)						
C _{iss}	Input Capacitance	V _{DS} =-10V,V _{GS} =0V, f=1MHz	--	796	--	pF
C _{oss}	Output Capacitance		--	107	--	pF
C _{rss}	Reverse Transfer Capacitance		--	85.0	--	pF
R _g	Gate Resistance	f=1MHz	--	9.5	--	Ω
Q _g	Total Gate Charge	V _{DS} =-10V,I _D =-4.5A, V _{GS} =-4.5V	--	9.0	--	nC
Q _{gs}	Gate Source Charge		--	2.3	--	nC
Q _{gd}	Gate Drain Charge		--	2.5	--	nC
Switching Characteristics						
t _{d(on)}	Turn on Delay Time	V _{DD} =-10V,I _D =-4.5A, R _G =3Ω, V _{GS} =-4.5V	--	12.0	--	ns
t _r	Turn on Rise Time		--	35.0	--	ns
t _{d(off)}	Turn Off Delay Time		-	30.0	--	ns
t _f	Turn Off Fall Time		--	10.0	--	ns
Source Drain Diode Characteristics						
V _{SD}	Forward on voltage	I _{SD} =-3.0A,V _{GS} =0V	--	-0.76	-1.0	V
t _{rr}	Reverse Recovery Time	T _J =25°C,I _{sd} =-3.0A, V _{GS} =0V	--	11.9	--	ns
Q _{rr}	Reverse Recovery Charge	di/dt=-10A/μs	--	7.5	--	nC

NOTE: ① Repetitive rating; pulse width limited by max. junction temperature.

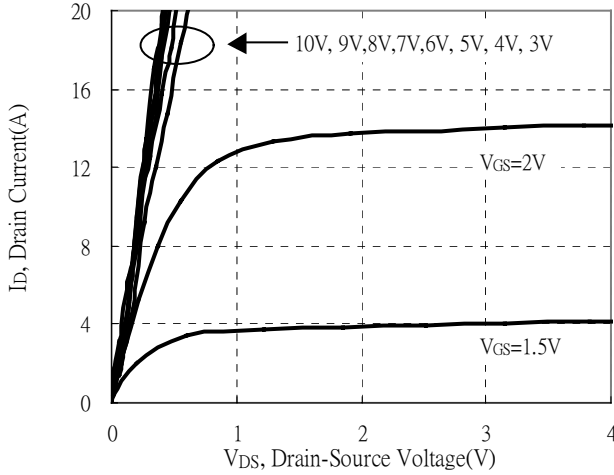
② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.5mH, R_G = 25Ω, I_{AS} = -5A, V_{GS} = -4.5V. Part not recommended for use above this value

③ The power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150°C.

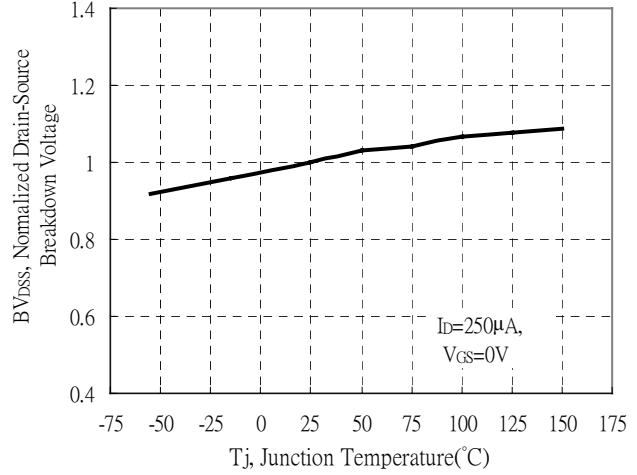
④ Pulse width ≤ 300μs; duty cycles ≤ 2%.

N-Typical Characteristics

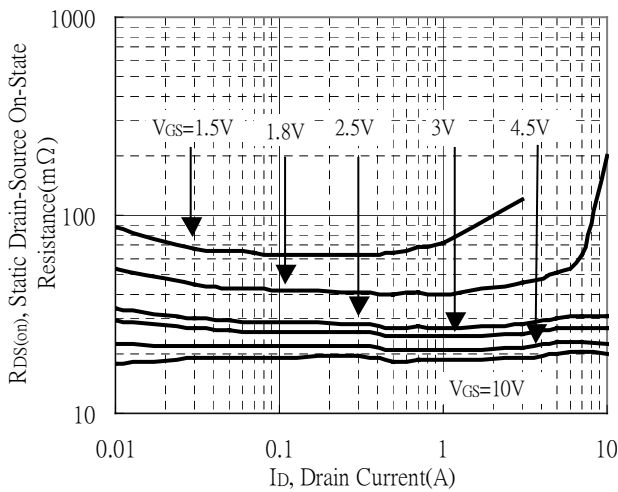
Typical Output Characteristics



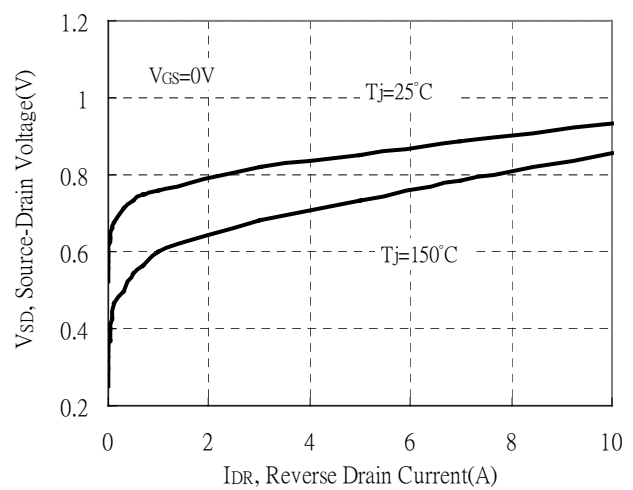
Brekdown Voltage vs Ambient Temperature



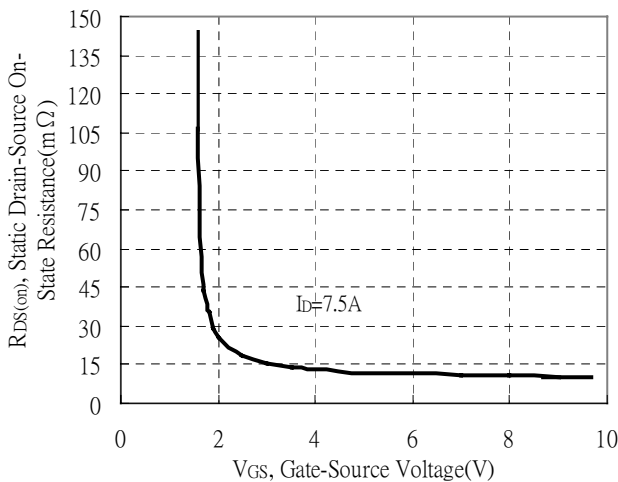
Static Drain-Source On-State resistance vs Drain Current



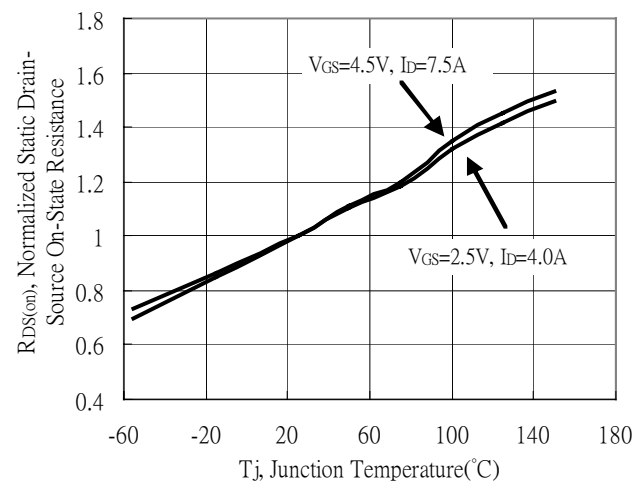
Reverse Drain Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

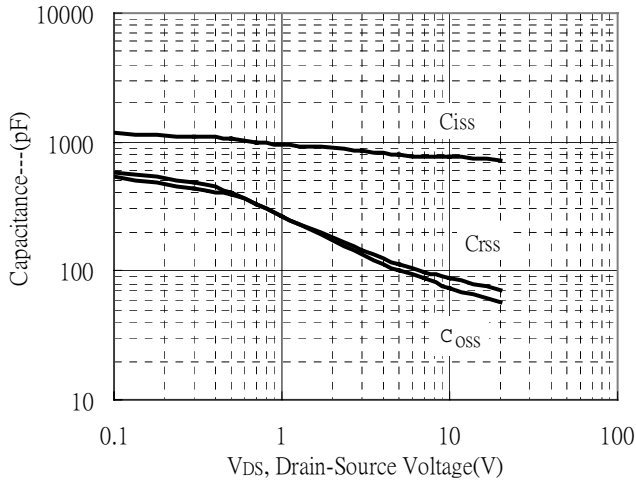


Drain-Source On-State Resistance vs Junction Temperature

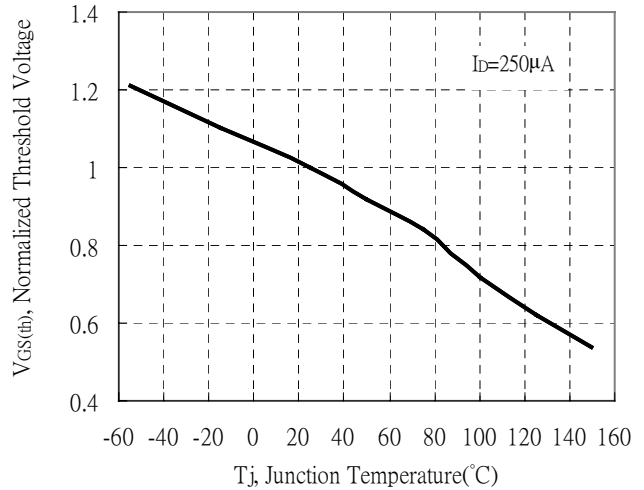


N-Typical Characteristics(Cont.)

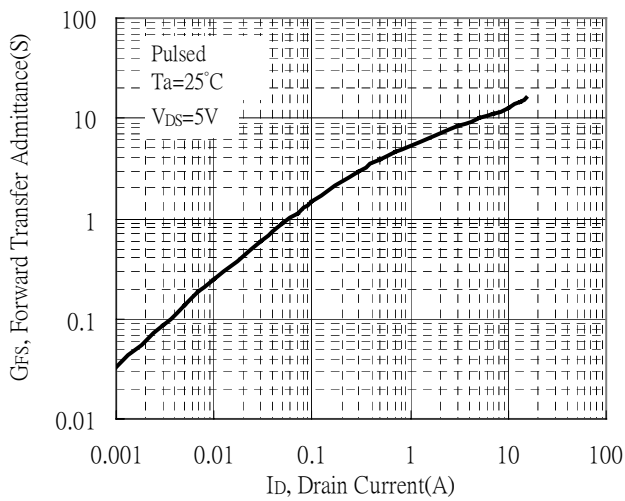
Capacitance vs Drain-to-Source Voltage



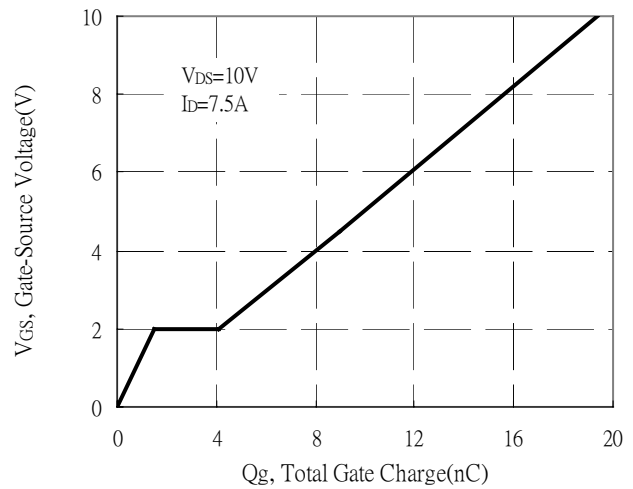
Threshold Voltage vs Junction Temperature



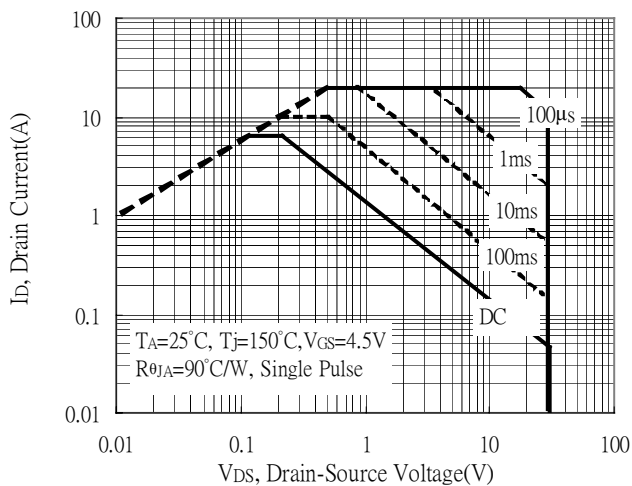
Forward Transfer Admittance vs Drain Current



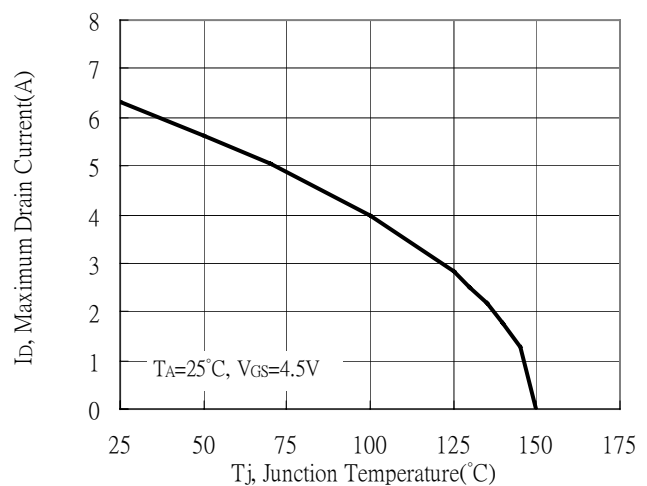
Gate Charge Characteristics



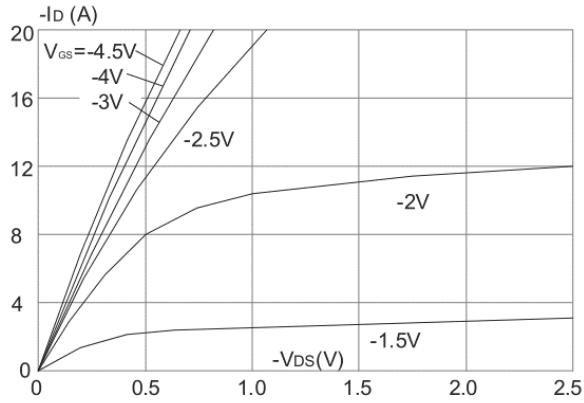
Maximum Safe Operating Area



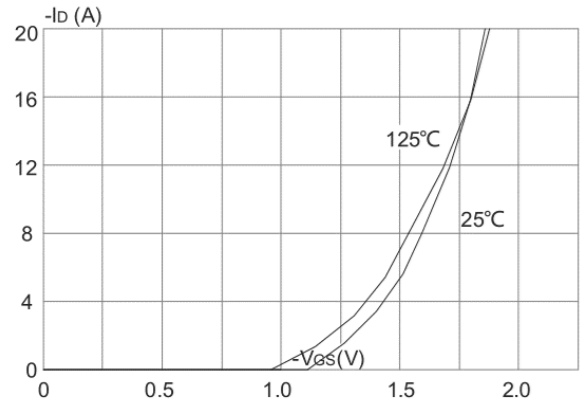
Maximum Drain Current vs Junction Temperature



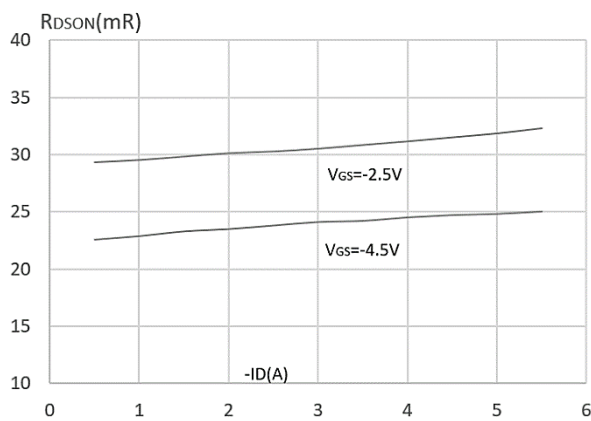
P-Typical Characteristics



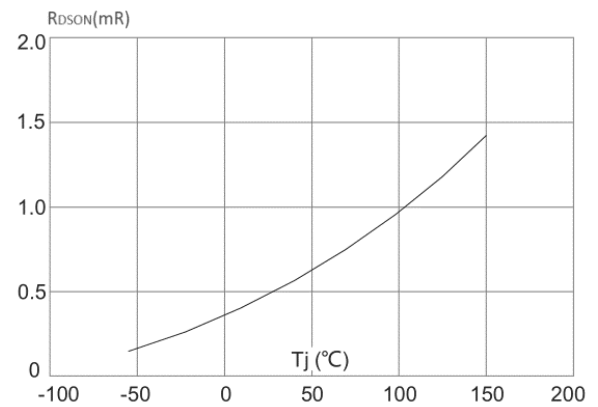
Output Characteristics



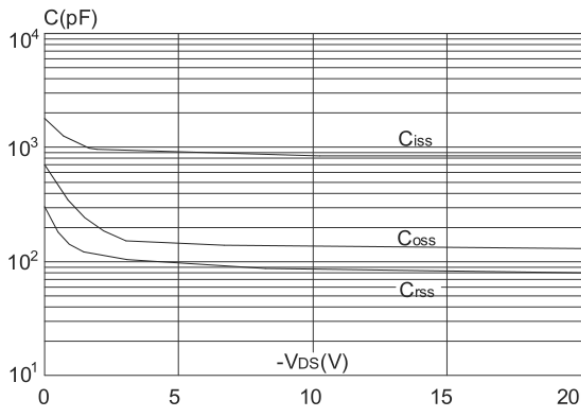
Transfer Characteristics



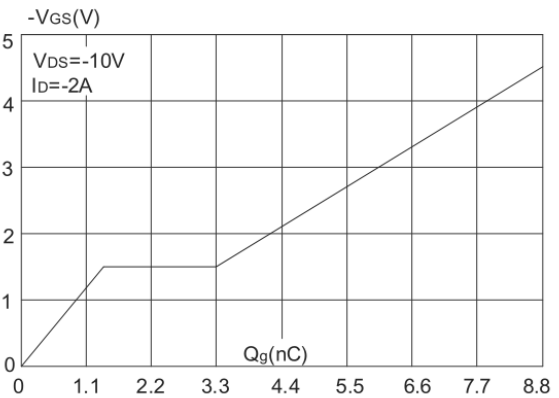
On-resistance vs. Drain Current



On-Resistance vs. Junction Temperature

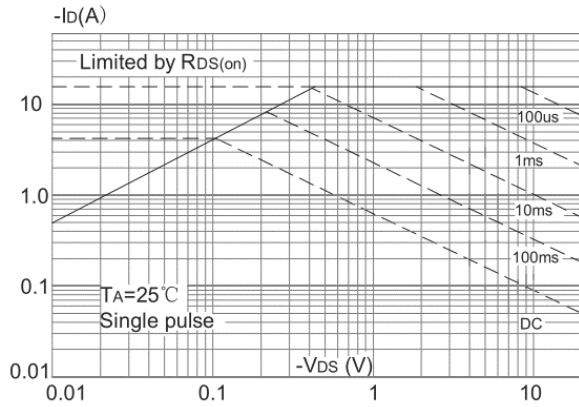


Capacitance Characteristics

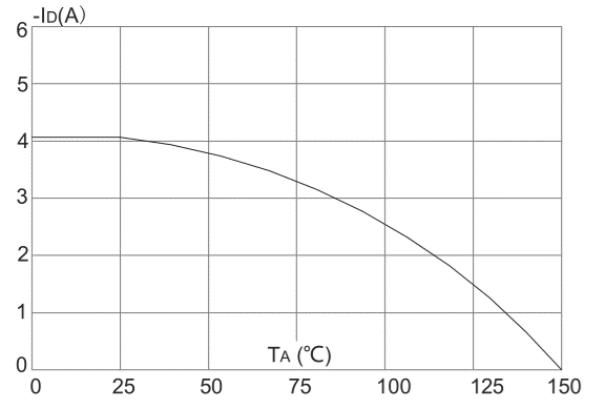


Gate Charge

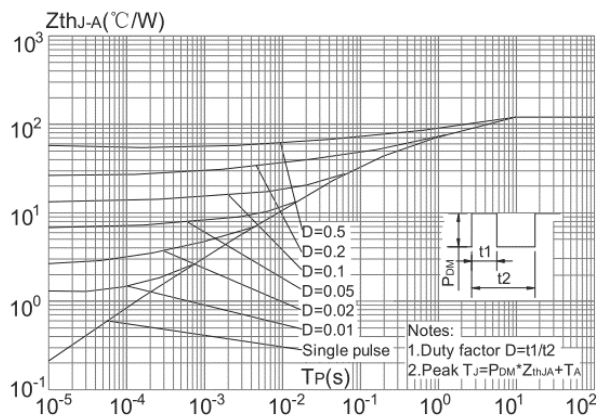
P-Typical Characteristics



Safe Operating Area

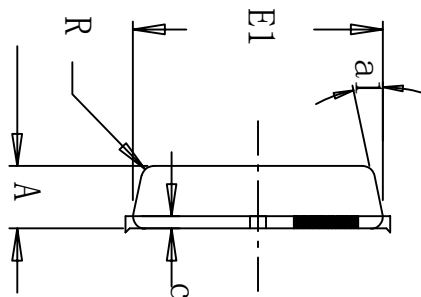
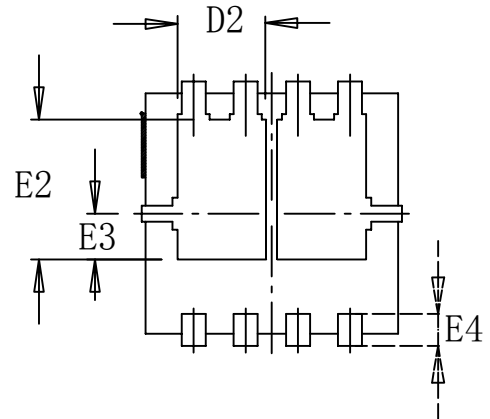
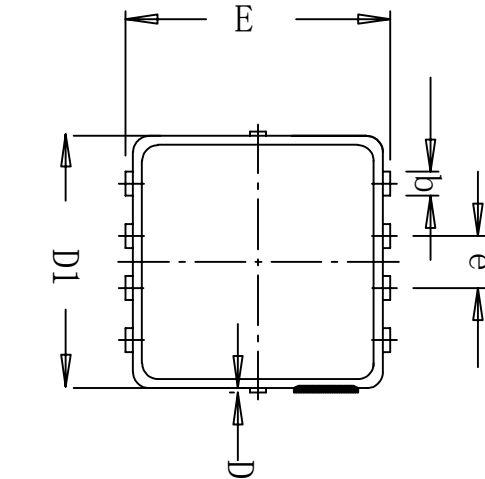


Maximum Continuous Drain Current vs. Ambient Temperature



Normalized Maximum Transient Thermal Impedance

Dual PDFN3333 Package Outline Data



△

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.75	0.78	0.81
b	0.297	0.3	0.35
c	—	0.152	—
D	0.00	0.05	0.1
D1	3.12	3.15	3.18
D2	—	1.05	—
E	3.2	3.3	3.4
E1	3.09	3.12	3.15
E2	—	1.75	—
E3	—	0.575	—
E4	—	0.4	—
R	—	0.15	—
e	0.65BSC		
a1°	—	12°	—