



TM20G04NF

N+P-Channel Enhancement Mode Mosfet

<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>General Features</b></p> <p><b>N Channel</b>  <math>V_{DS} = 40V, I_D = 20A</math>  <math>R_{DS(ON)} = 17m\Omega @ V_{GS} = 10V</math></p> <p><b>P Channel</b>  <math>V_{DS} = -40V, I_D = -20A</math>  <math>R_{DS(ON)} = 33m\Omega @ V_{GS} = -10V</math></p> <p>100% UIS Tested              100% <math>R_g</math> Tested</p>
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NF:DFN5x6-8L

Marking: 4020

Pin 1

G1 S1      G2 S2

**Absolute Maximum Ratings** ( $T_C = 25^\circ C$  unless otherwise specified)

Symbol	Parameter	Max. N-Channel	Max. P-Channel	Units
$V_{DSS}$	Drain-Source Voltage	40	-40	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ C$	-18	A
		$T_C = 100^\circ C$	-14	A
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	68	-54	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>note2</sup>	19	27.5	mJ
$P_D$	Power Dissipation	9.6	22	W
$R_{\theta JA}$	Thermal Resistance, Junction to Case	13	5.7	$^\circ C/W$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150		$^\circ C$



## TM20G04NF

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N-Channel Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	40	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =40V, V <sub>GS</sub> =0V	-	-	1.0	μA
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V	-	-	±100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	1.0	1.5	2.5	V
R <sub>DS(on)</sub>	Static Drain-Source on-Resistance note3	V <sub>GS</sub> =10V, I <sub>D</sub> =8A	-	17	24	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A	-	25	35	mΩ
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1.0MHz	-	633	-	pF
C <sub>oss</sub>	Output Capacitance		-	67	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	58	-	pF
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =20V, I <sub>D</sub> =8A, V <sub>GS</sub> =10V	-	12	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	3.2	-	nC
Q <sub>gd</sub>	Gate-Drain("Miller") Charge		-	3.1	-	nC
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = 20V, R <sub>L</sub> =2.5Ω V <sub>GS</sub> =10V, R <sub>REN</sub> =3Ω	-	4	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	3	-	ns
t <sub>d(off)</sub>	Turn-off Delay Time		-	15	-	ns
t <sub>f</sub>	Turn-off Fall Time		-	2	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	20	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	32	A
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> = 8A	-	-	1.2	V

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=20V, V<sub>G</sub>=10V, L=0.5mH, R<sub>g</sub>=25Ω, I<sub>AS</sub>=7.2AT<sub>J</sub>=25°C, V<sub>DD</sub>=-20V, V<sub>G</sub>= -10V, L=0.5mH, R<sub>g</sub>=25Ω, I<sub>AS</sub>=-8.4A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

**TM20G04NF**

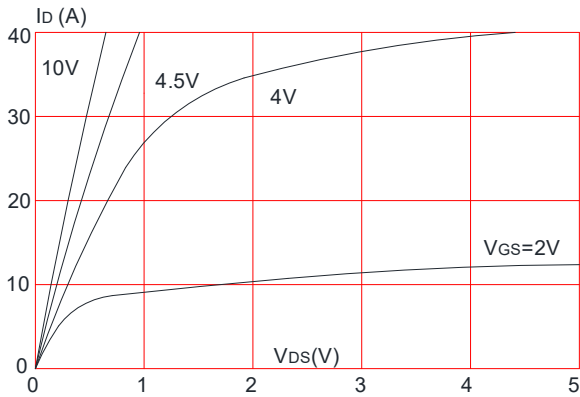
**N+P-Channel Enhancement Mode Mosfet**

**P-Channel Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

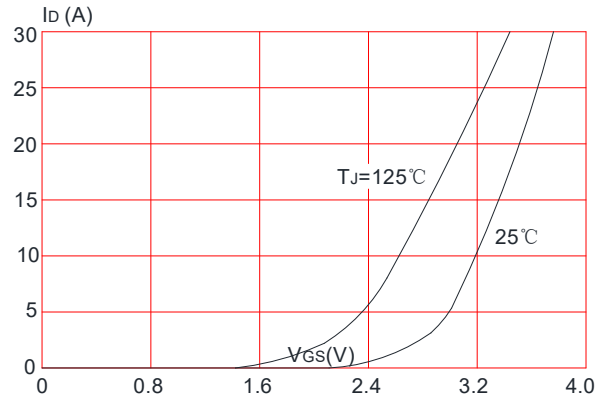
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=-40V, V_{GS}=0V$	-	-	-1	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS}=\pm 20V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1.0	-1.5	-2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note3	$V_{GS}=-10V, I_D=-8A$	-	33	38	m $\Omega$
		$V_{GS}=-4.5V, I_D=-5A$	-	39	50	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=-20V, V_{GS}=0V,$ $f=1.0MHz$	-	1034	-	pF
$C_{oss}$	Output Capacitance		-	107	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	79.5	-	pF
$Q_g$	Total Gate Charge	$V_{DS}=-20V, I_D=-8A,$ $V_{GS}=-10V$	-	20	-	nC
$Q_{gs}$	Gate-Source Charge		-	3.5	-	nC
$Q_{gd}$	Gate-Drain("Miller") Charge		-	4.2	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=-20V, I_D=-16A,$ $V_{GS}=-10V, R_{GEN}=2.5\Omega$	-	8	-	ns
$t_r$	Turn-on Rise Time		-	15	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	23	-	ns
$t_f$	Turn-off Fall Time		-	9	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain to Source Diode Forward Current		-	-	-20	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-64	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_S=-16A$	-	-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS}=0V, I_S=-16A,$	-	29	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	20	-	nC

### Typical Performance Characteristics-N

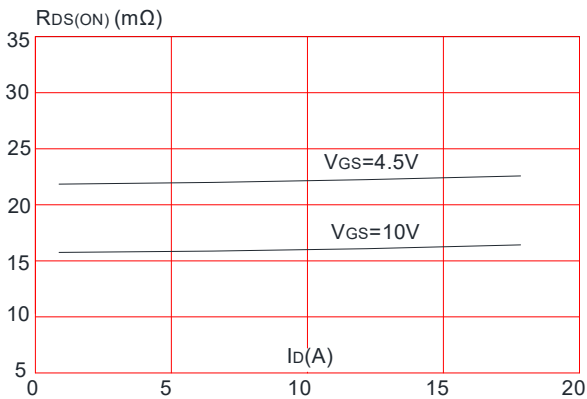
**Figure 1: Output Characteristics**



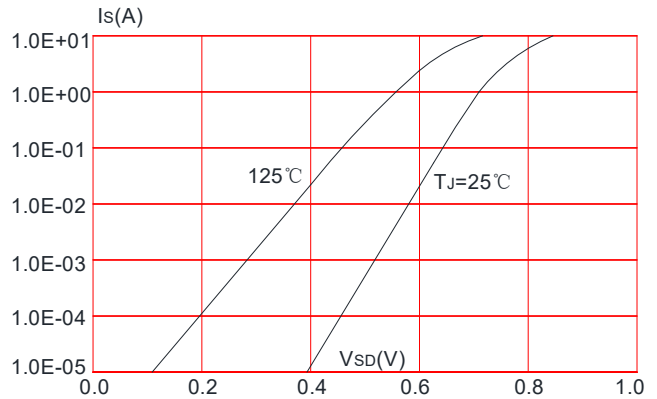
**Figure 2: Typical Transfer Characteristics**



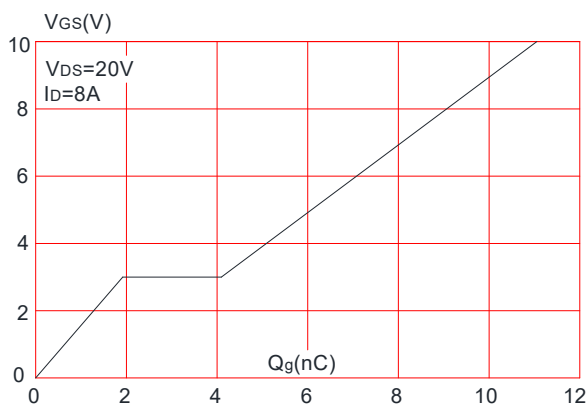
**Figure 3: On-resistance vs. Drain Current**



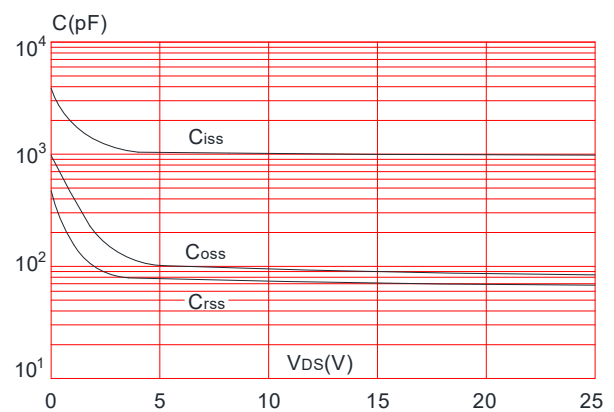
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**



**Figure 6: Capacitance Characteristics**



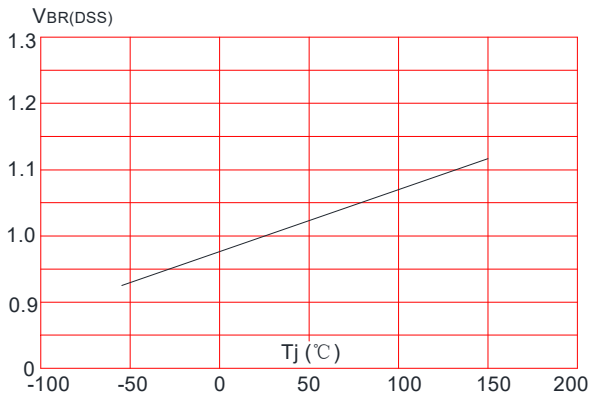




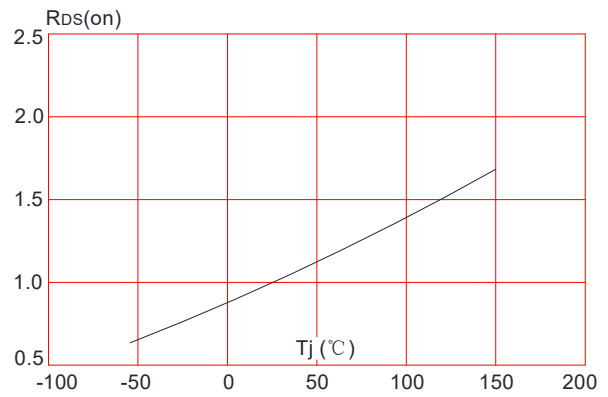
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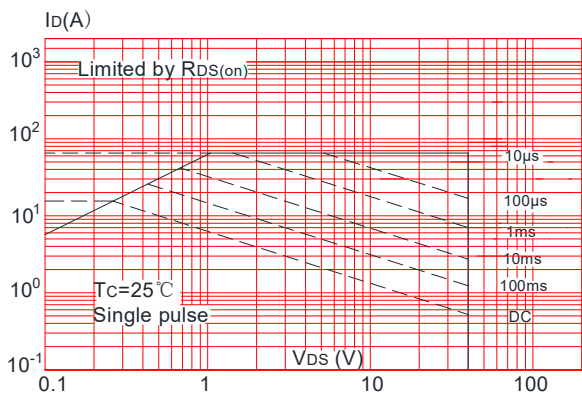
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



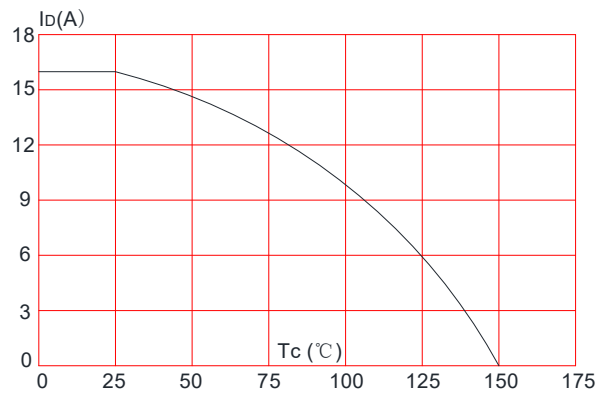
**Figure 8:** Normalized on Resistance vs. Junction Temperature



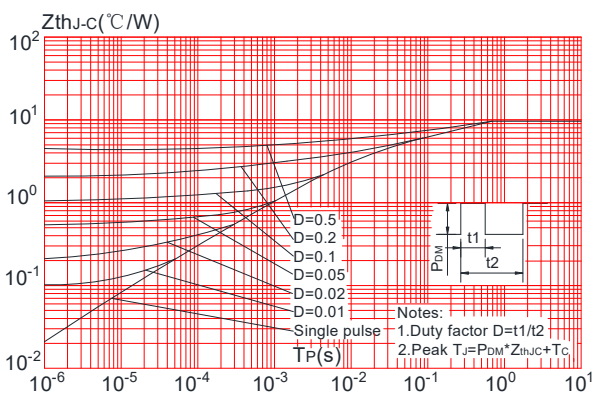
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Case Temperature



Maximum Effective Transient Thermal Impedance, Junction-to-Case



### Typical Performance Characteristics-P

Figure 1: Output Characteristics

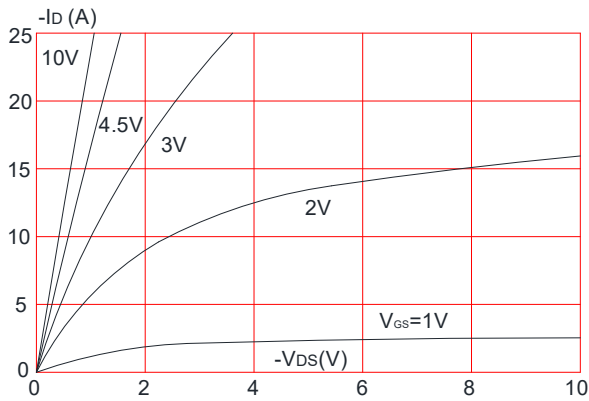


Figure 2: Typical Transfer Characteristics

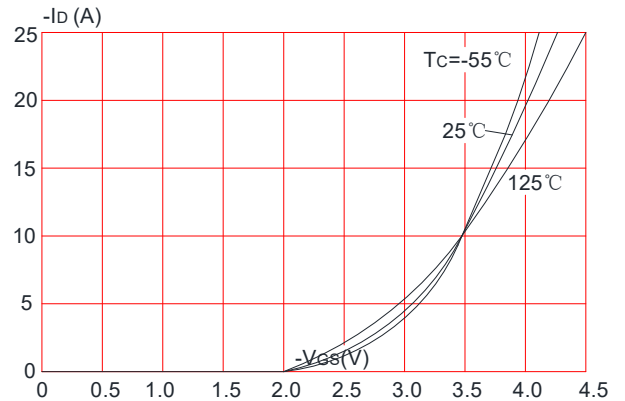


Figure 3: On-resistance vs. Drain Current

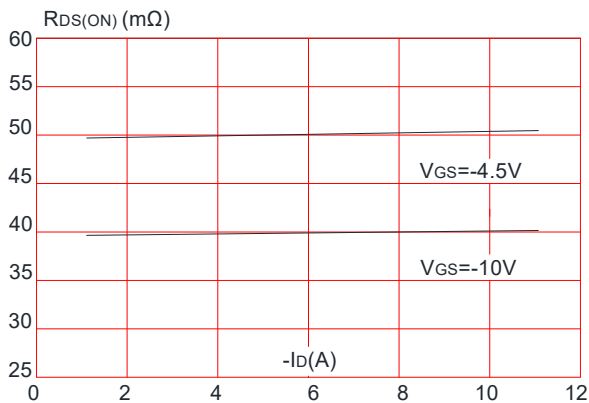


Figure 4: Body Diode Characteristics

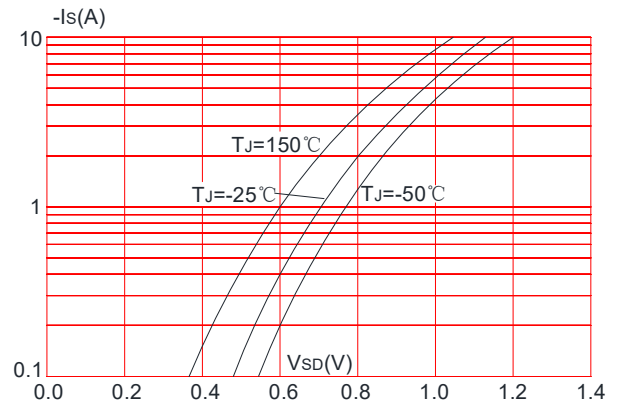


Figure 5: Gate Charge Characteristics

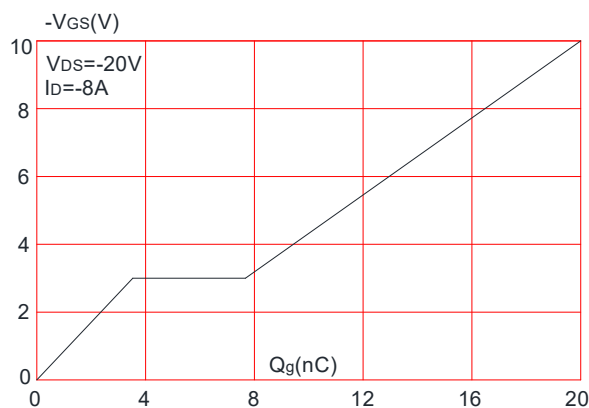
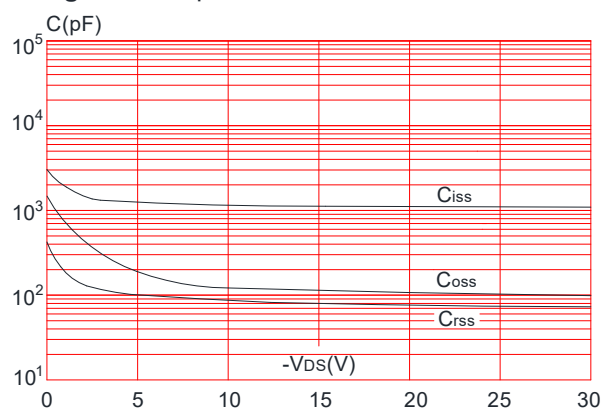


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

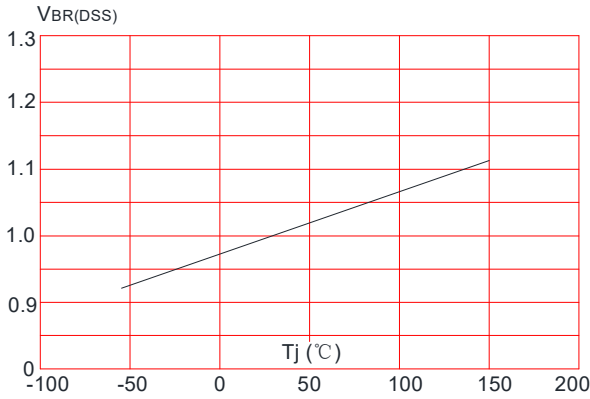


Figure 8: Normalized on Resistance vs. Junction Temperature

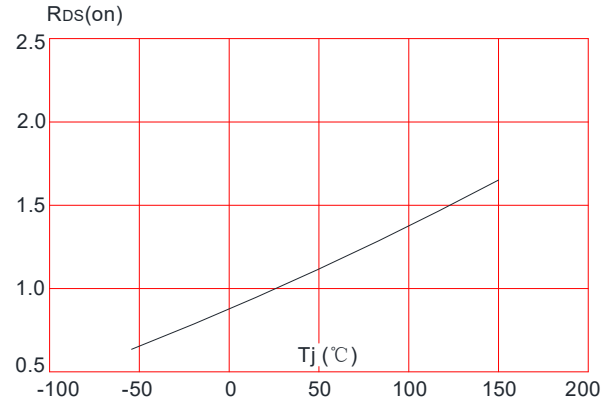


Figure 9: Maximum Safe Operating Area

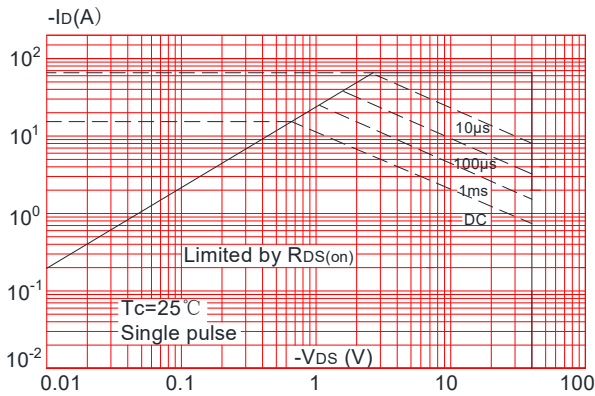


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

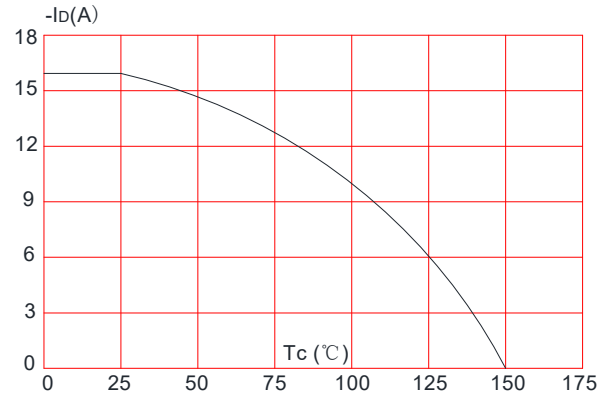
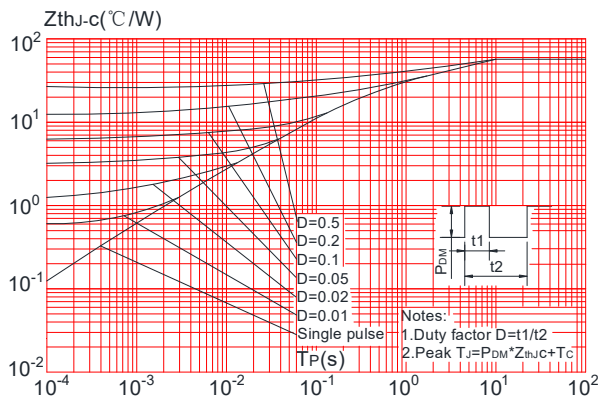
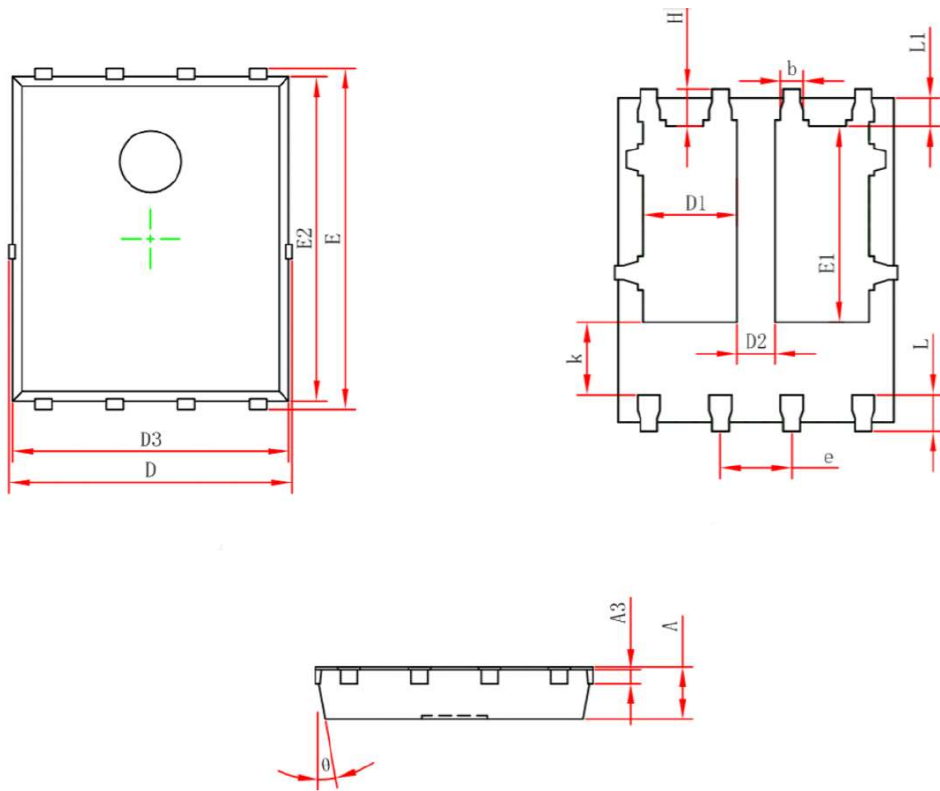


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case



## Package Mechanical Data:DFN5x6-8L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A3	0.154REF.		0.006REF.	
D	4.944	5.096	0.195	0.201
E	5.974	6.126	0.235	0.241
D1	1.470	1.870	0.058	0.074
D2	0.470	0.870	0.019	0.034
E1	3.375	3.575	0.133	0.141
D3	4.824	4.976	0.190	0.196
E2	5.674	5.826	0.223	0.229
k	1.190	1.390	0.047	0.055
b	0.350	0.450	0.014	0.018
e	1.270TYP.		0.050TYP.	
L	0.559	0.711	0.022	0.028
L1	0.424	0.576	0.017	0.023
H	0.574	0.726	0.023	0.029
$\theta$	10°	12°	10°	12°