Integrated P-Channel Enhancement Mode Power MOSFET and Schottky Diode

Description

The NCE20PK0302U uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for DC-DC conversion applications.

General Features

MOSFET

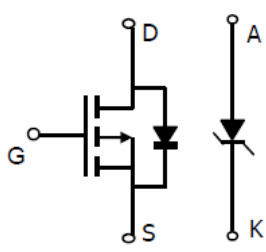
- V_{DS} = -20V,I_D = -3.9A
  $R_{DS(ON)}$ < 105mΩ @ V_{GS}=-4.5V
  $R_{DS(ON)}$ < 140mΩ @ V_{GS}=-2.5V
  $R_{DS(ON)}$ < 170mΩ @ V_{GS}=-1.8V

Schottky Diode

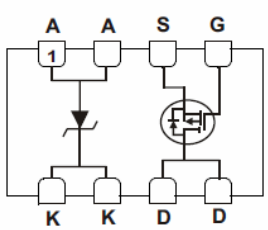
- V_{KA}(V) = 20V, I_F = 2A, V_F<0.45V@0.5A

Application

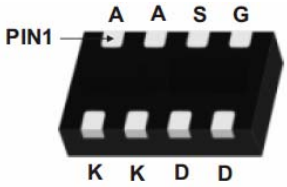
- Bidirectional blocking switch
- DC-DC conversion applications



Schematic diagram



Marking and pin assignment



DFN2X3-8L Bottom View

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
0302	NCE20PK0302U	DFN2X3-8L	Ø180mm	8 mm	3000 units

Absolute Maximum Ratings (T_A=25℃unless otherwise noted)

Parameter		Symbol	MOSFET	Schottky	Unit
Drain-Source Voltage		V_{DS}	-20		V
Gate-Source Voltage		V_{GS}	±12		V
Drain Current-Continuous (Note 2)	T_A=25°C	I_D	-3.9		A
	T_A=70°C		-3		A
Drain Current -Pulsed (Note 1)			-15		
Schottky reverse voltage				20	V
Continuous Forward Current (Note 2)	T_A=25°C	I_F		2	A
	T_A=70°C			1.5	
Pulsed Forward Current (Note 1)				8	A
Power Dissipation	T_A=25°C	P_D	2.3	1.45	W
	T_A=70°C		1.45	0.92	
Operating Junction and Storage Temperature Range		T_J,T_{STG}	-55 To 150	-55 To 150	℃

Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance,Junction-to-Ambient (Note 2) **(MOSFET)**	$R_{\theta JA}$	78	89	℃/W
Thermal Resistance,Junction-to-Ambient (Note 2) **(Schottky)**	$R_{\theta JA}$	87	107	℃/W

Electrical Characteristics (T_A=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=-250μA	-20		-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=-20V,V_{GS}=0V	-	-	-1	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±12V,V_{DS}=0V	-	-	±100	nA
On Characteristics						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=-250μA	-0.4	-0.75	-1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=-4.5V, I_D=-3 A	-	88	105	mΩ
		V_{GS}=-2.5V, I_D=-2A	-	116	140	mΩ
		V_{GS}=-1.8V, I_D=-2A		150	170	mΩ
Forward Transconductance	g_{FS}	V_{DS}=-5V,I_D=-3A		6	-	S
Dynamic Characteristics						
Input Capacitance	C_{lss}	V_{DS}=-10V,V_{GS}=0V, F=1.0MHz	-	450	-	PF
Output Capacitance	C_{oss}		-	65	-	PF
Reverse Transfer Capacitance	C_{rss}		-	50	-	PF
Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=-10V, R_L=5Ω V_{GS}=-4.5V,R_{GEN}=3Ω	-	6	-	nS
Turn-on Rise Time	t_r		-	14	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	28	-	nS
Turn-Off Fall Time	t_f		-	20	-	nS
Total Gate Charge	Q_g	V_{DS}=-10V,I_D=-3A, V_{GS}=-4.5V	-	4.8	-	nC
Gate-Source Charge	Q_{gs}		-	1	-	nC
Gate-Drain Charge	Q_{gd}		-	0.9	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage	V_{SD}	I_F=-3A	-	-	-1.2	V
Diode Forward Current	I_S		-	-	-1.2	A
Schottky Parameter						
Forward Voltage Drop	V_F	V_{GS}=0V,I_S=0.5A	-	0.43	0.45	V
Reverse Breakdown Voltage	V_{BR}	I_R=100μA	20			V
Maximum reverse leakage current T_J=25°C	I_{rm}	V_R=20V	-	20	100	μA
Maximum reverse leakage current T_J=125°C				5.1	10	mA
Junction Capacitance	C_T	V_R=10V	-	35	-	pF

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.

2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The value in any given application depends on the user's specific board design.Surface Mounted on FR4 Board, t ≤ 10 sec. The current rating is based on the t ≤ 10s thermal resistance rating.

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

4. Guaranteed by design, not subject to production .

Typical Electrical and Thermal Characteristics : MOSFET

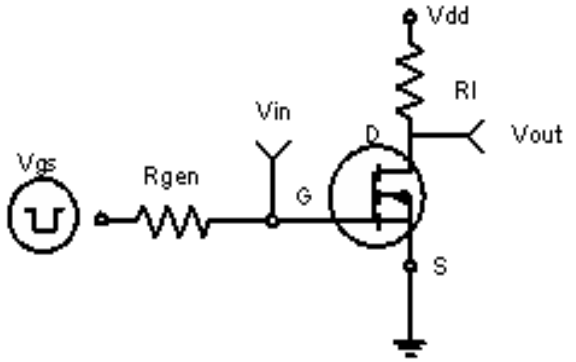


Figure 1:Switching Test Circuit

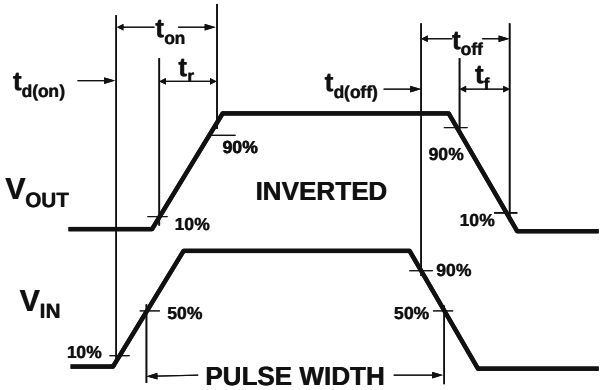


Figure 2:Switching Waveforms

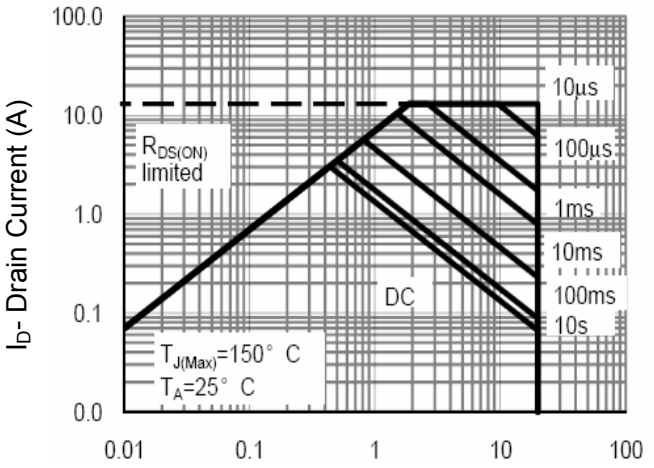


Figure 3 Safe Operation Area

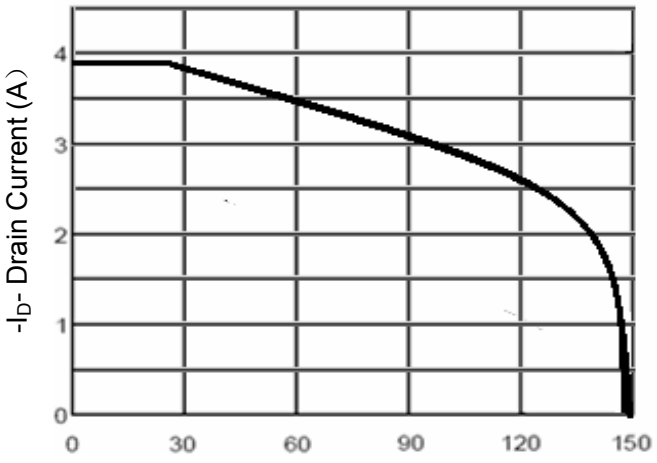


Figure 4 Drain Current

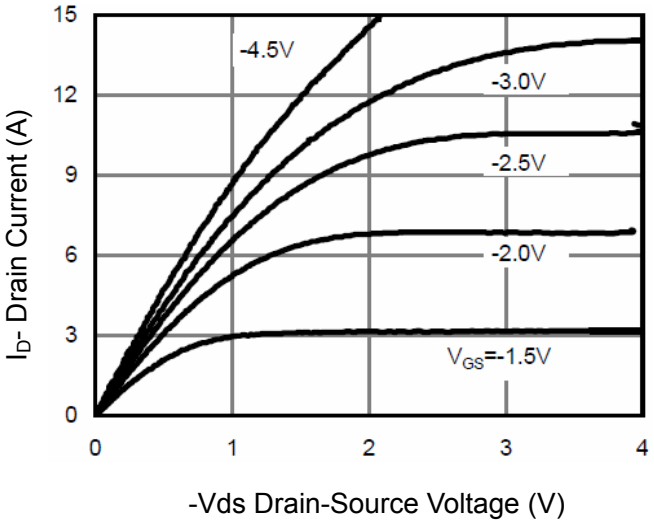


Figure 5 Output Characteristics

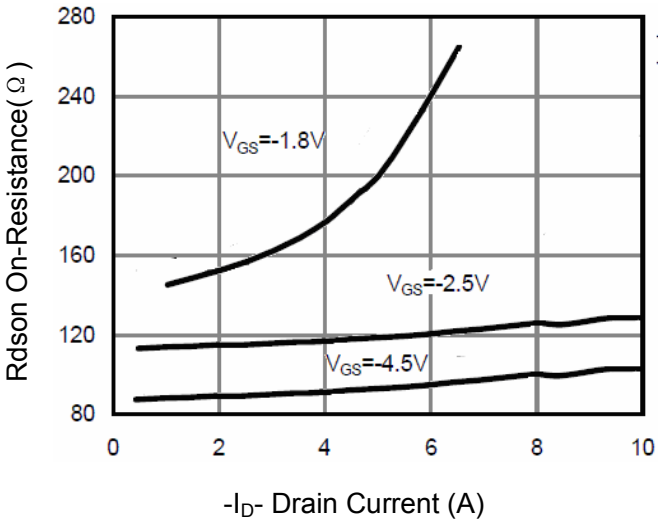


Figure 6 Drain-Source On-Resistance

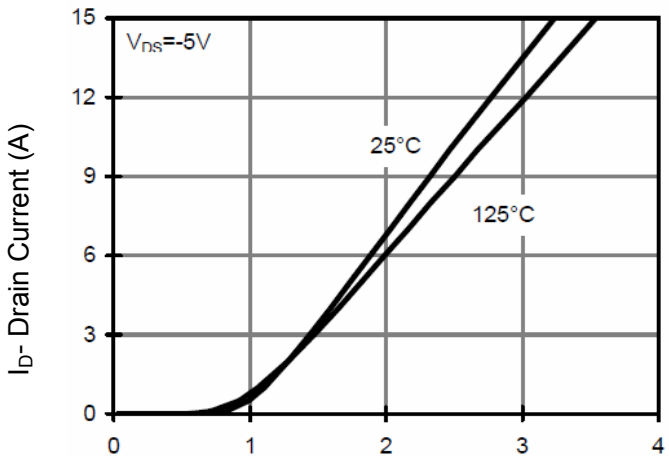


Figure 7 Transfer Characteristics

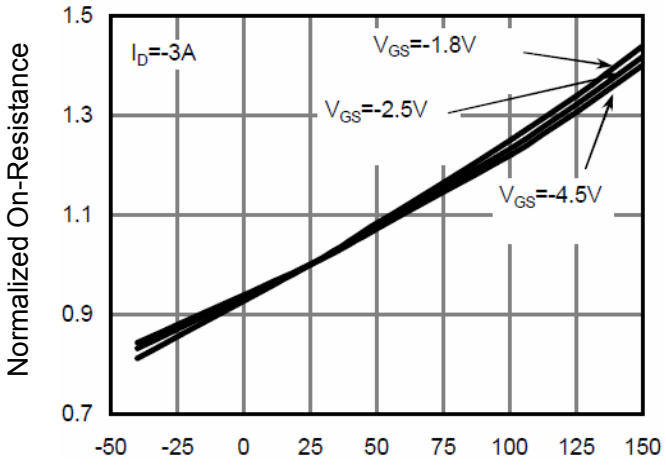


Figure 8 Drain-Source On-Resistance

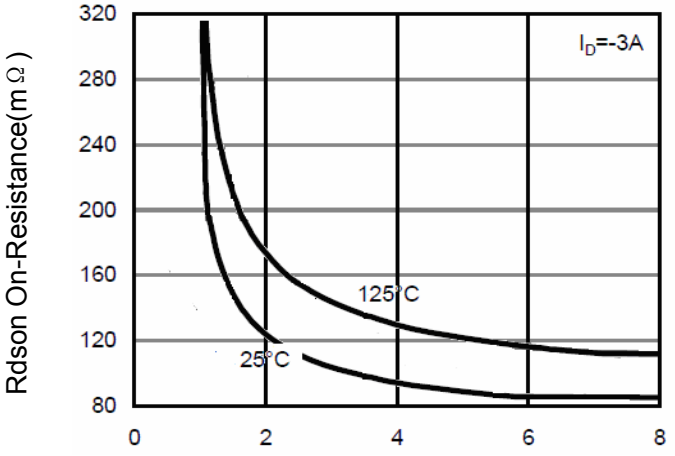


Figure 9 Rdson vs Vgs

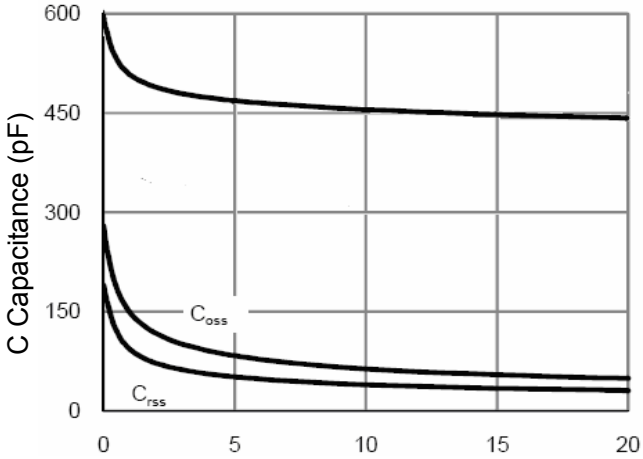


Figure 10 Capacitance vs Vds

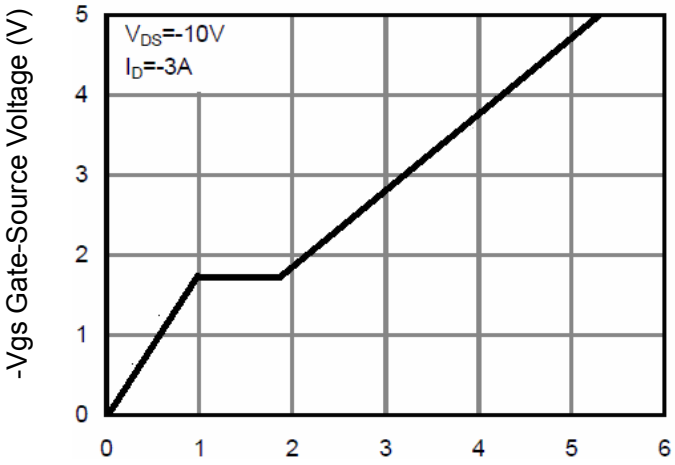


Figure 11 Gate Charge

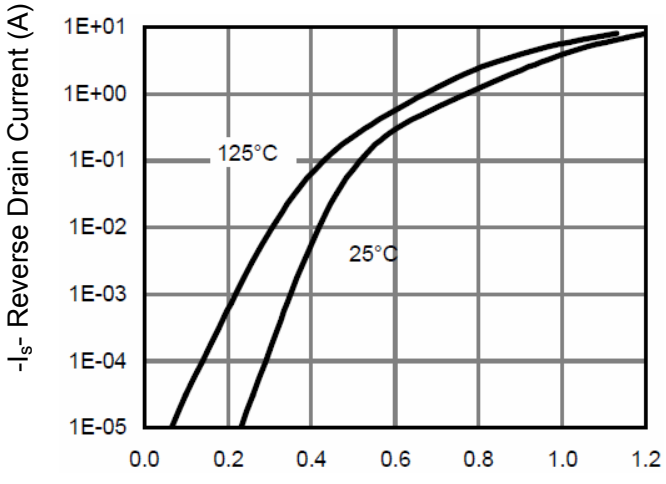


Figure 12 Source- Drain Diode Forward

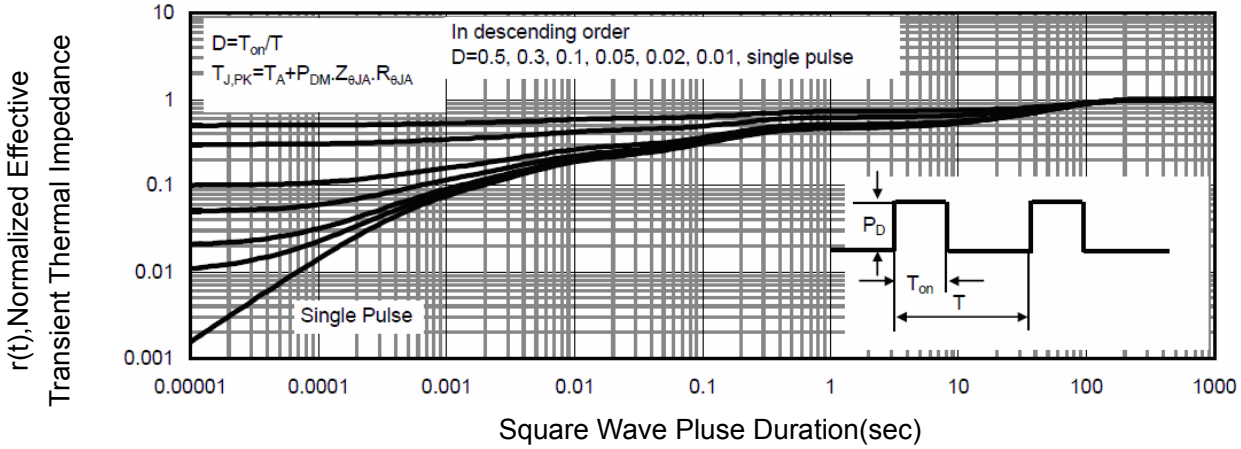


Figure 13 Normalized Maximum Transient Thermal Impedance

Typical Electrical and Thermal Characteristics : Schottky

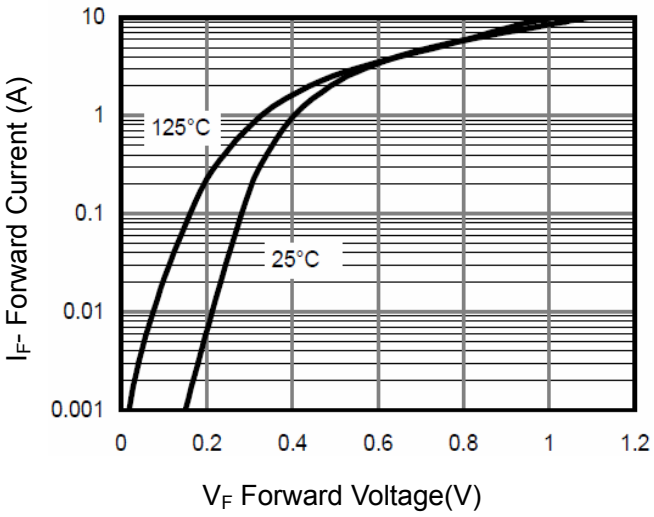


Figure 14 Schottky Forward Characteristics

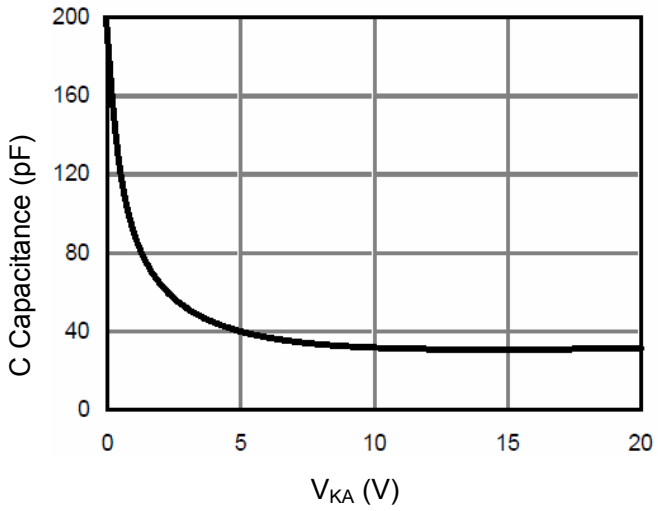


Figure 15 Schottky Capacitance

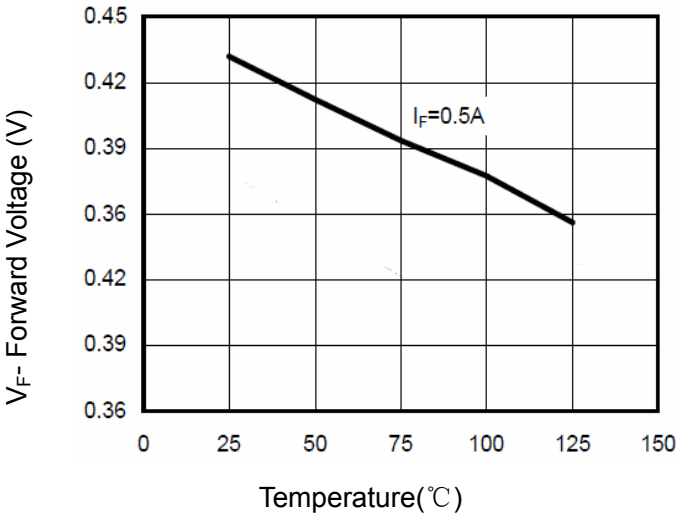


Figure 16 Schottky Forward vs. Junction Temperature

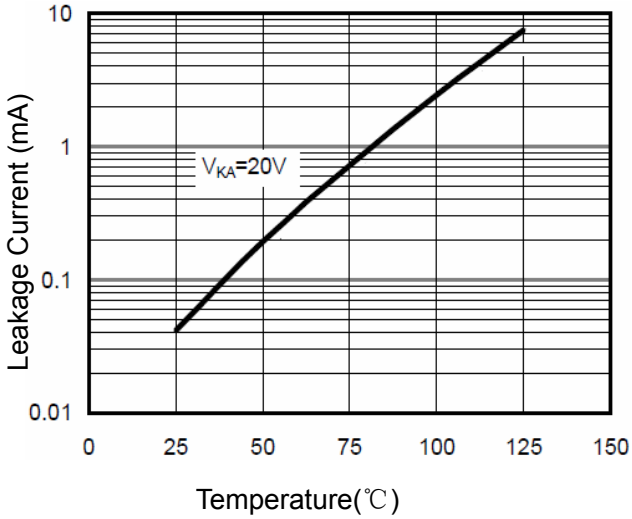
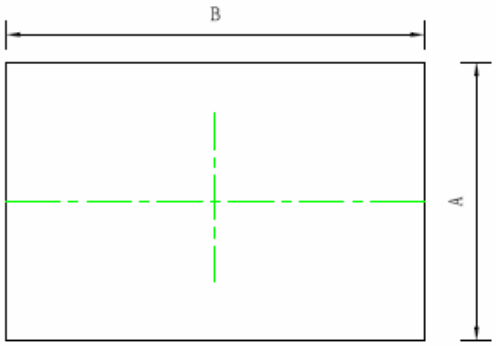
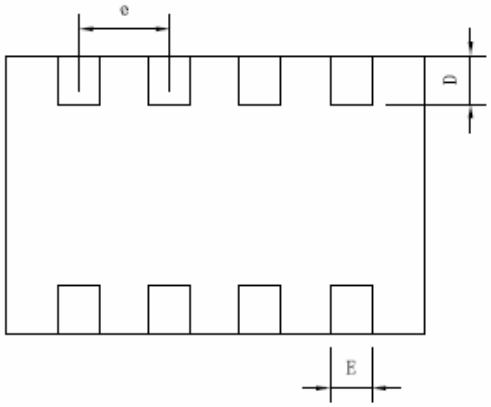
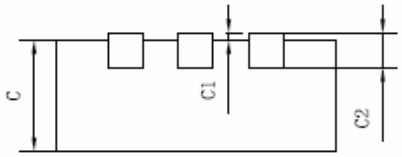


Figure 17 Schottky Forward vs. Junction Temperature

DFN2X3-8L Package Information







SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.95	2.00	2.05
B	2.95	3.00	3.05
C	0.75	0.80	0.85
C1			0.05
C2	0.18	0.20	0.22
D	0.28	0.35	0.42
E	0.25	0.30	0.35
e	0.65 TYP		

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