

Integrated P-Channel Enhancement Mode Power MOSFET and Schottky Diode

Description

The NCE20PK0302J 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

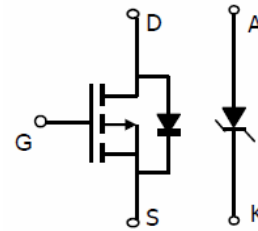
- $V_{DS} = -20V, I_D = -3A$
 $R_{DS(ON)} < 105m\Omega @ V_{GS} = -4.5V$
 $R_{DS(ON)} < 140m\Omega @ V_{GS} = -2.5V$
 $R_{DS(ON)} < 170m\Omega @ V_{GS} = -1.8V$

Schottky Diode

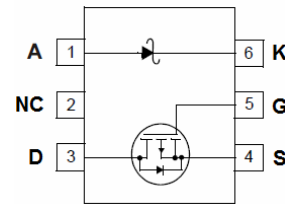
- $V_{KA}(V) = 20V, I_F = 2A, V_F < 0.45V @ 0.5A$

Application

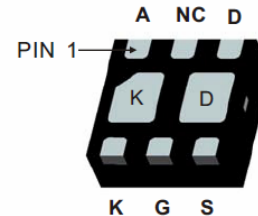
- Bidirectional blocking switch
- DC-DC conversion applications



Schematic diagram



Marking and pin assignment



DFNWB2X2-6L Bottom View

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
0302	NCE20PK0302J	DFNWB2X2-6L	Ø180mm	8 mm	3000 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ 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)	I_D	$T_A = 25^\circ C$	-3	A	
		$T_A = 70^\circ C$	-2.3	A	
Drain Current -Pulsed (Note 1)	I_{DM}	-9		A	
Schottky reverse voltage	V_{KA}		20	V	
Continuous Forward Current (Note 2)	I_F	$T_A = 25^\circ C$	2	A	
		$T_A = 70^\circ C$	1.5	A	
Pulsed Forward Current (Note 1)	I_{FM}		6	A	
Power Dissipation	P_D	$T_A = 25^\circ C$	1.5	1.45	W
		$T_A = 70^\circ C$	0.95	0.92	
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ C$	

Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Ambient ^(Note 2) (MOSFET)	$R_{\theta JA}$	85	105	°C/W
Thermal Resistance, Junction-to-Ambient ^(Note 2) (Schottky)	$R_{\theta JA}$	87	107	°C/W

Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=-250\mu A$	-20		-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-20V, V_{GS}=0V$	-	-	-1	μA	
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	± 100	nA	
On Characteristics							
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.75	-1	V	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=-4.5V, I_D=-3A$	-	88	105	m Ω	
		$V_{GS}=-2.5V, I_D=-2A$	-	116	140	m Ω	
		$V_{GS}=-1.8V, I_D=-2A$		150	170	m Ω	
Forward Transconductance	g_{FS}	$V_{DS}=-5V, I_D=-3A$		6	-	S	
Dynamic Characteristics							
Input Capacitance	C_{iss}	$V_{DS}=-10V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	450	-	PF	
Output Capacitance	C_{oss}		-	65	-	PF	
Reverse Transfer Capacitance	C_{rss}		-	50	-	PF	
Switching Characteristics							
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-10V, R_L=5\Omega$ $V_{GS}=-4.5V, R_{GEN}=3\Omega$	-	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		-	-	-1.1	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}	$I_R=100\mu A$	20			V	
Maximum reverse leakage current	$T_J=25^\circ\text{C}$	I_{rm}		-	20	100	μA
	$T_J=125^\circ\text{C}$				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 $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board, $t \leq 10$ sec. The current rating is based on the $t \leq 10$ s thermal resistance rating.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics : MOSFET

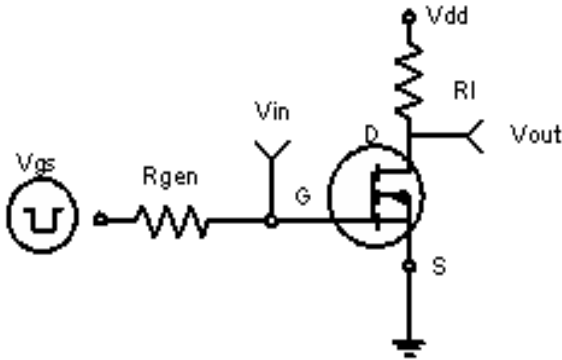


Figure 1: Switching Test Circuit

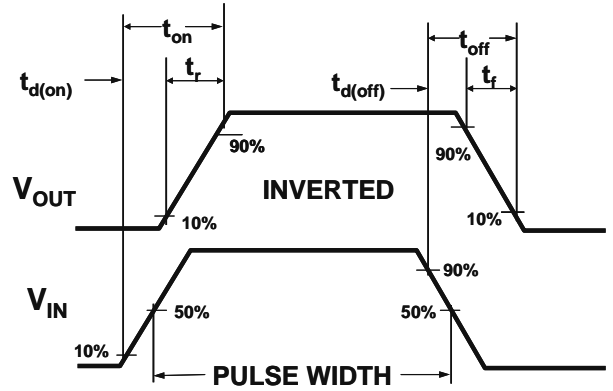


Figure 2: Switching Waveforms

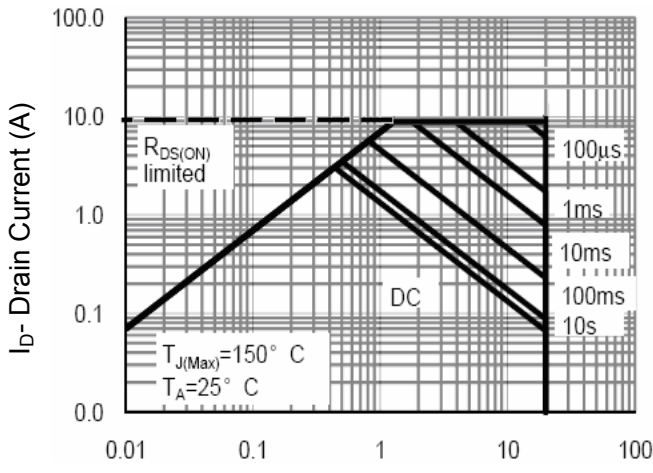


Figure 3 Safe Operation Area

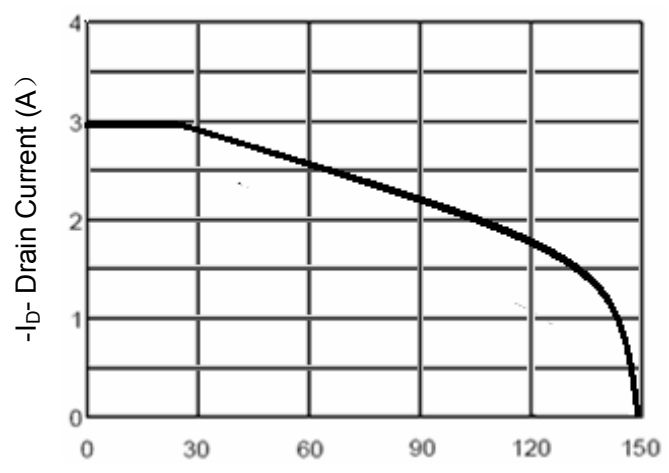


Figure 4 Drain Current

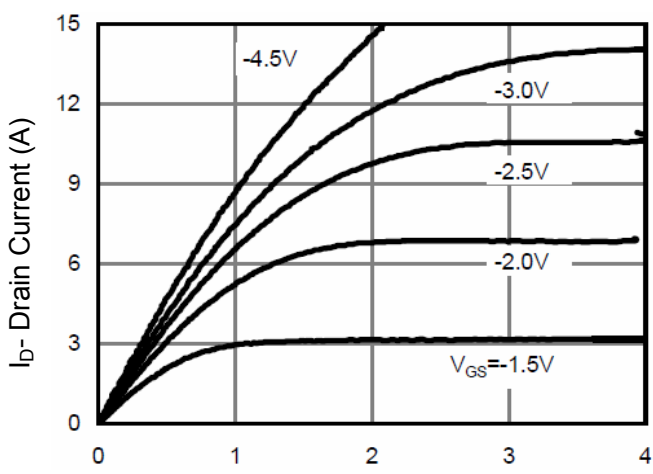


Figure 5 Output Characteristics

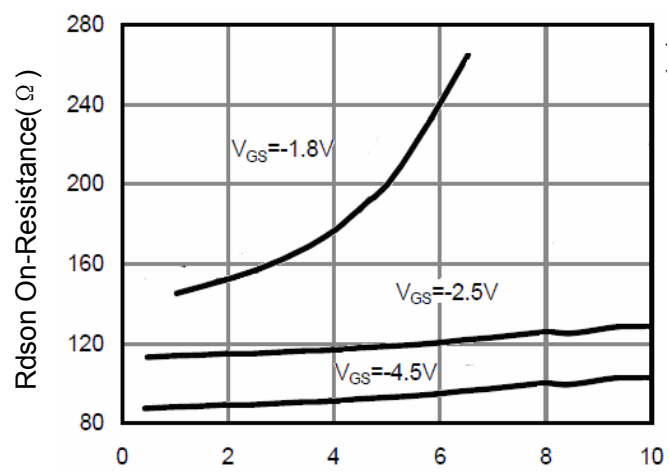
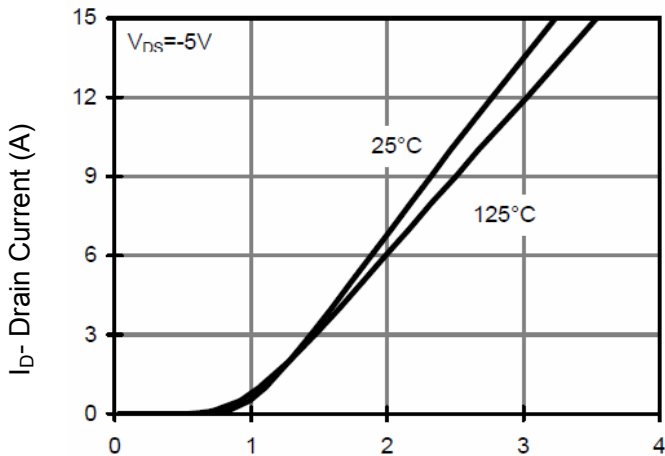
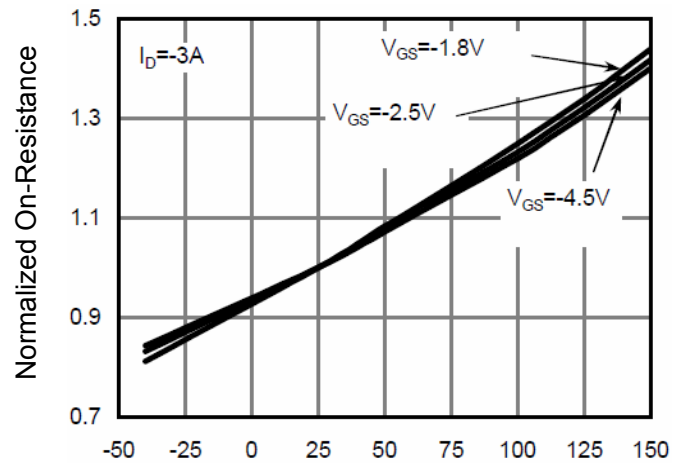


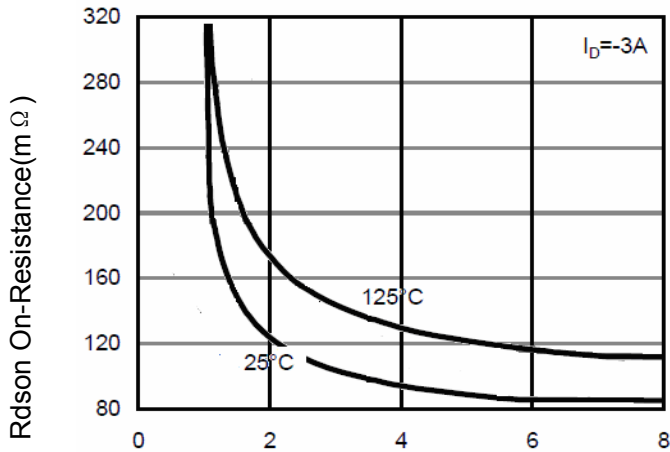
Figure 6 Drain-Source On-Resistance



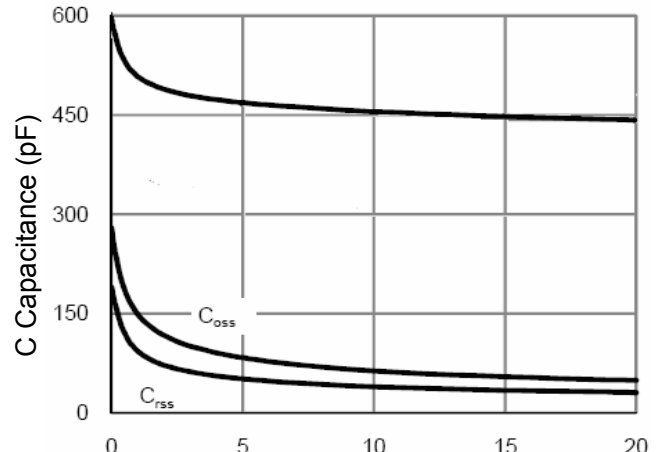
-Vgs Gate-Source Voltage (V)
Figure 7 Transfer Characteristics



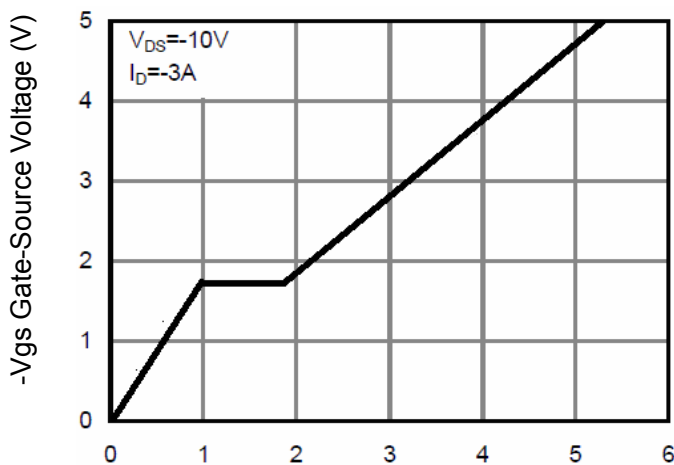
T_J -Junction Temperature(°C)
Figure 8 Drain-Source On-Resistance



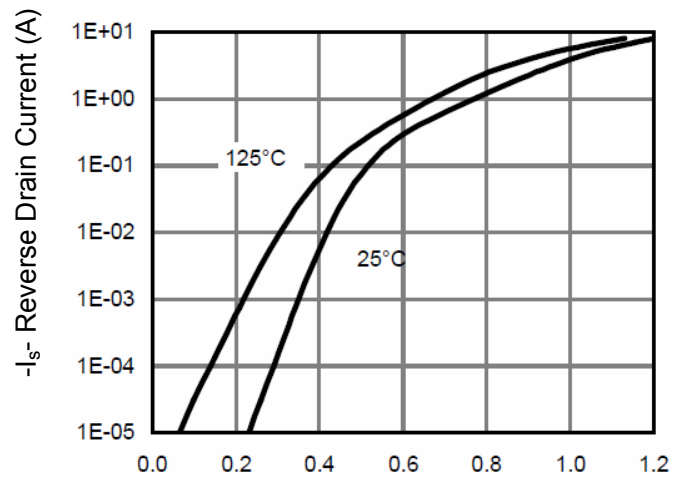
-Vgs Gate-Source Voltage (V)
Figure 9 Rdson vs Vgs



-Vds Drain-Source Voltage (V)
Figure 10 Capacitance vs Vds



Qg Gate Charge (nC)
Figure 11 Gate Charge



-Vsd Source-Drain Voltage (V)
Figure 12 Source- Drain Diode Forward

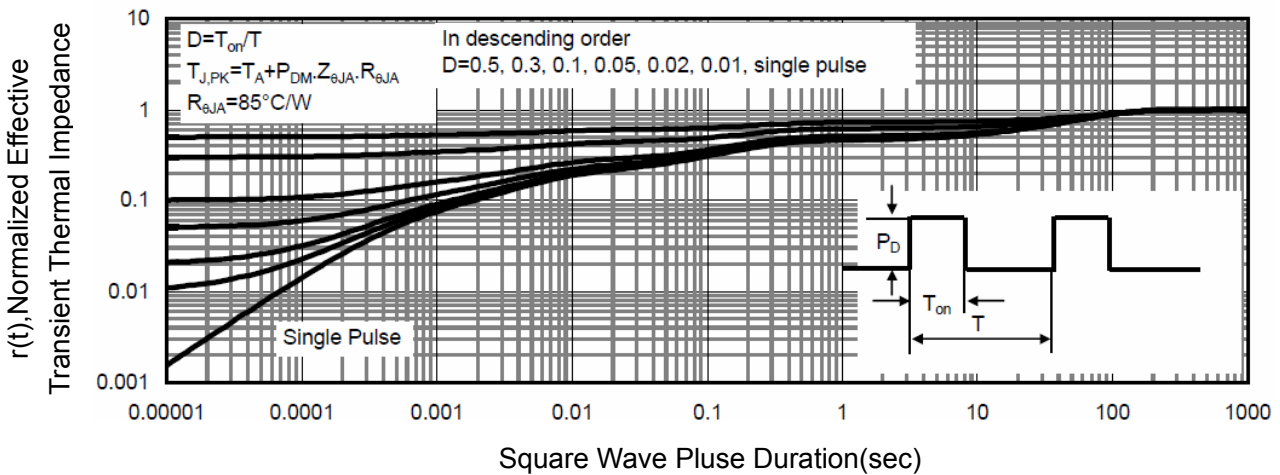


Figure 13 Normalized Maximum Transient Thermal Impedance

Typical Electrical and Thermal Characteristics : Schottky

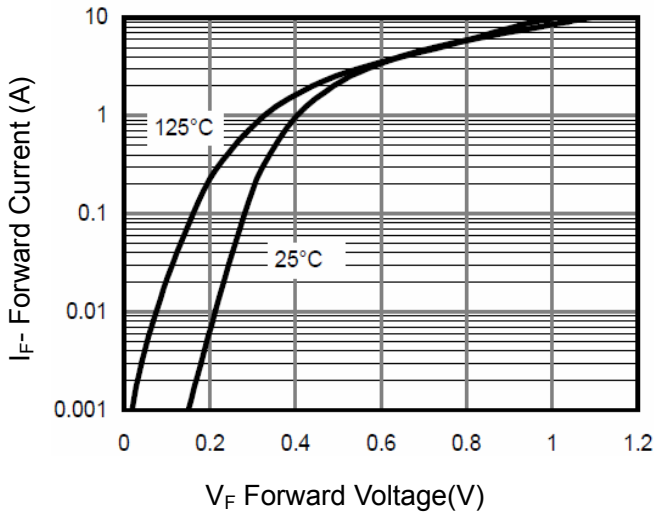


Figure 14 Schottky Forward Characteristics

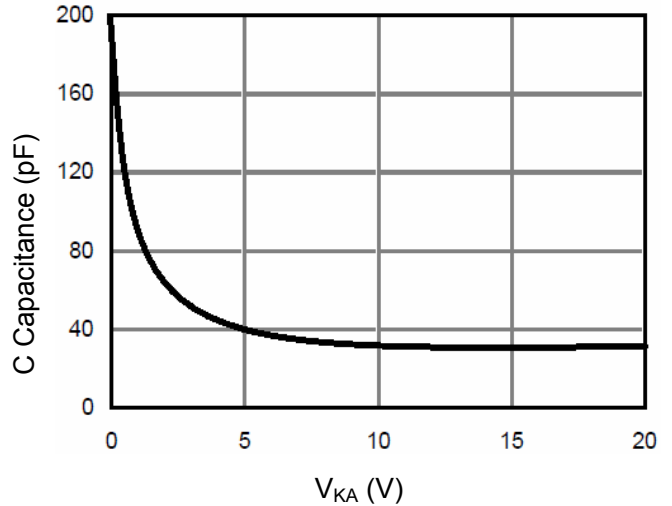


Figure 15 Schottky Capacitance

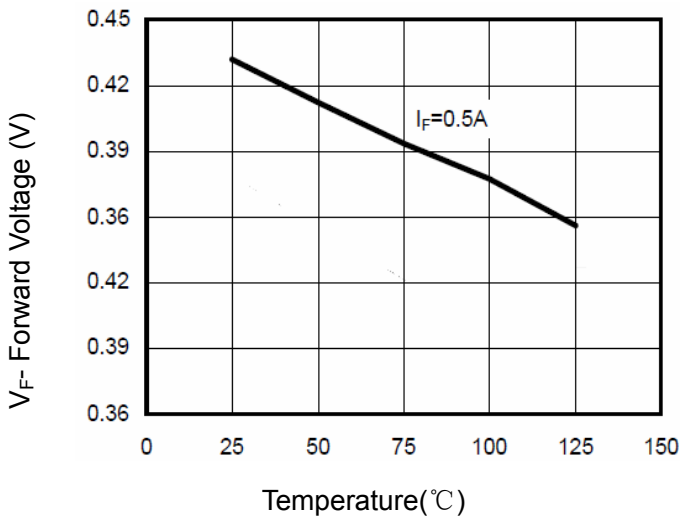


Figure 16 Schottky Forward vs. Junction Temperature

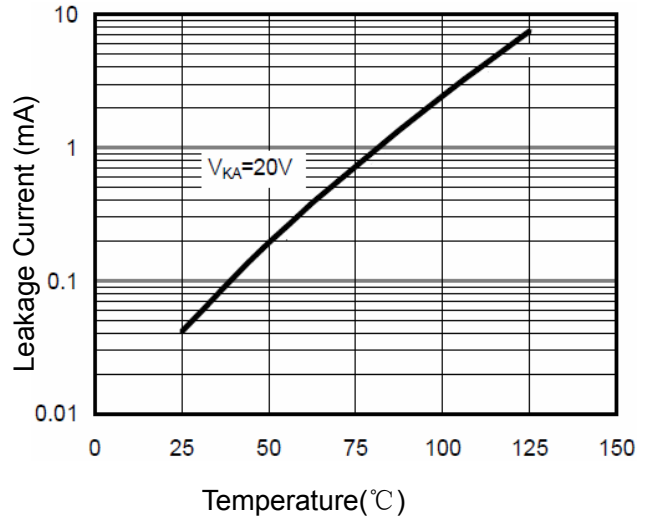
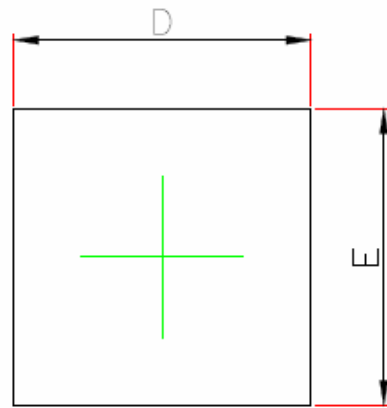
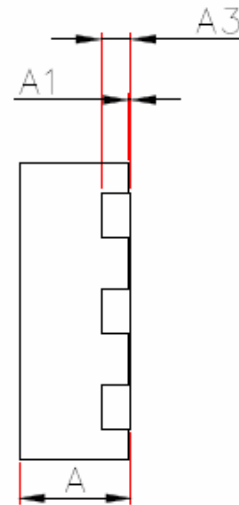


Figure 17 Schottky Forward vs. Junction Temperature

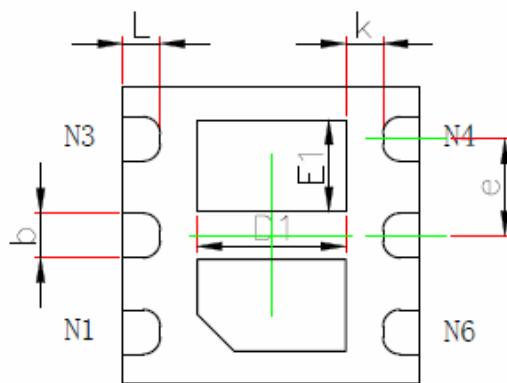
DFNWB2X2-6L Package Information



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	0.520	0.720	0.020	0.028
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
k	0.200MIN.		0.008MIN.	
L	0.200	0.300	0.008	0.012

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