

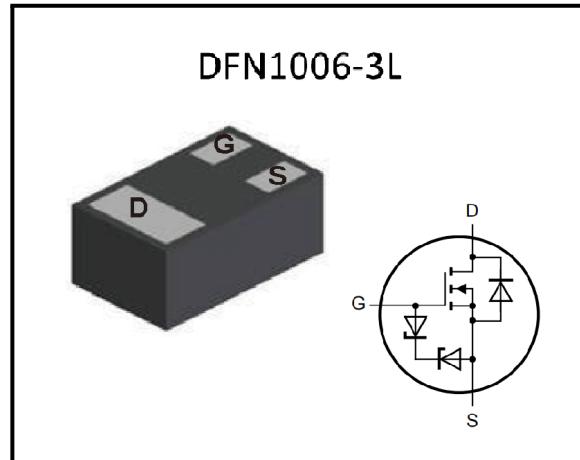
# 2N7002KN

N-Channel MOSFET

## Features

- $V_{DS}=60V$
- $I_D=0.35A$
- $R_{DS(ON)} @ V_{GS}=10V, TYP=1.5\Omega$
- $R_{DS(ON)} @ V_{GS}=4.5V, TYP=1.7\Omega$
- Logic-level compatible
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 2kV HBM

## Package



## Applications

- Relay driver
- High-speed line driver
- Low-side loadswitch
- Switching circuits

## Marking

72K

## Ordering information

Order code	Package	Marking	Base qty	Delivery mode
2N7002KN	DFN1006-3L	72K	10K	Tape and reel

## Absolute Maximum Ratings (@ $T_A=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-Source Voltage	60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current	0.35	A
$I_{DM}$	Peak Continuous Drain Current	0.9	A
$P_D$	Maximum Power Dissipation	250	mW
$T_J$	Junction Temperature	-55 to + 150	$^\circ C$
$T_{stg}$	Storage Temperature	-55 to + 150	$^\circ C$
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance	500	$^\circ C/W$

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# 2N7002KN

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Electrical Characteristics (@ $T_A=25^\circ C$  unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	—	—	V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.6	2.5	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=60V, V_{GS}=0V$	—	—	1	$\mu A$
$I_{GSS1}$	Gate Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	—	—	$\pm 10$	$\mu A$
$I_{GSS2}$		$V_{GS}=\pm 10V, V_{DS}=0V$	—	—	$\pm 1$	$\mu A$
$I_{GSS3}$		$V_{GS}=\pm 5V, V_{DS}=0V$	—	—	$\pm 0.3$	$\mu A$
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=10V, I_D=0.3A$	—	1.5	2	$\Omega$
		$V_{GS}=4.5V, I_D=0.2A$	—	1.7	2.4	
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=0.2A$	—	0.6	—	S
$R_G$	Internal Gate Resistance (AC)	$f=2.5MHz$	—	2.5	—	$\Omega$
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=10V,$ $V_{GS}=0V,$ $f=1MHz$	—	23.6	—	pF
$C_{oss}$	Output Capacitance		—	4.6	—	
$C_{rss}$	Reverse Transfer Capacitance		—	3	—	
$Q_g$	Gate to Drain Charge	$V_{DS}=30V,$ $V_{GS}=10V,$ $I_D=0.2A$	—	1	—	nC
$Q_{gs}$	Gate to Source Charge		—	0.12	—	
$Q_{gd}$	Gate to Drain Charge		—	0.18	—	
$T_{d(on)}$	Turn-on delay time	$V_{DS}=50V,$ $V_{GS}=10V,$ $I_D=0.2A,$ $R_G=6\Omega$	—	4.7	—	ns
$T_r$	Turn-on Rise time		—	4.3	—	
$T_{d(off)}$	Turn-Off Delay Time		—	6.9	—	
$T_f$	Turn-Off Fall time		—	2.9	—	
<b>Source-Drain Diode</b>						
$V_{SD}$	Diode Forward Voltage	$I_S=0.2A, V_{GS}=0V$	—	0.87	1.2	V



Typical Performance Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

Figure 1: Normalized total power dissipation as a function of junction temperature

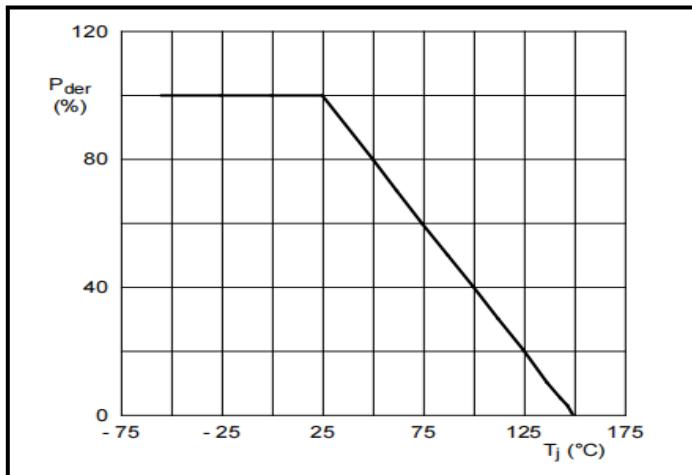


Figure 2: Normalized continuous drain current as a function of junction temperature

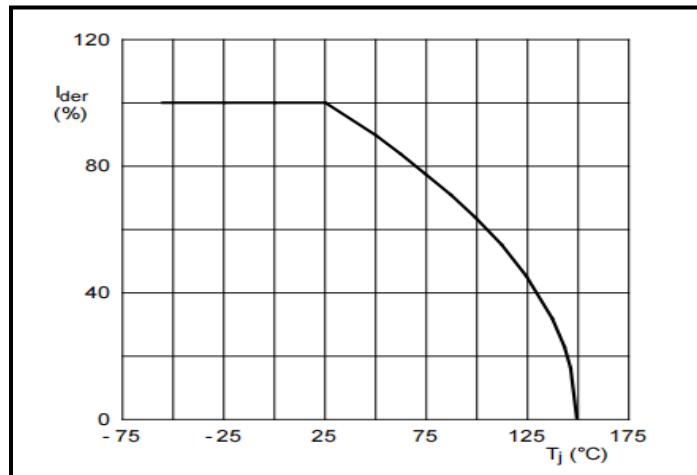
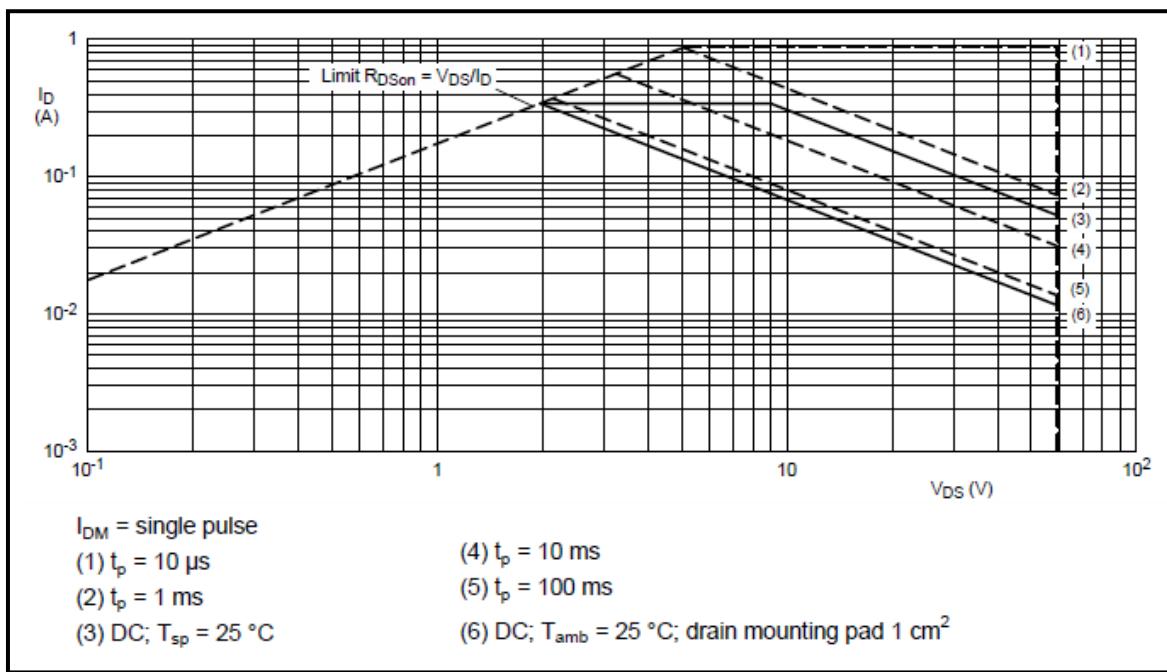


Figure 3: Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage



Typical Performance Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

Figure 4: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

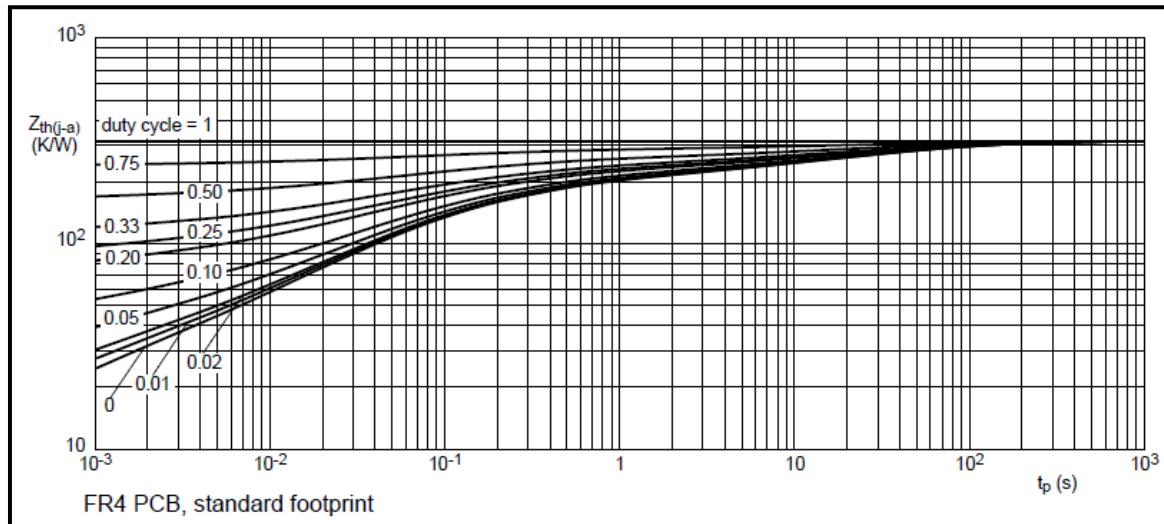
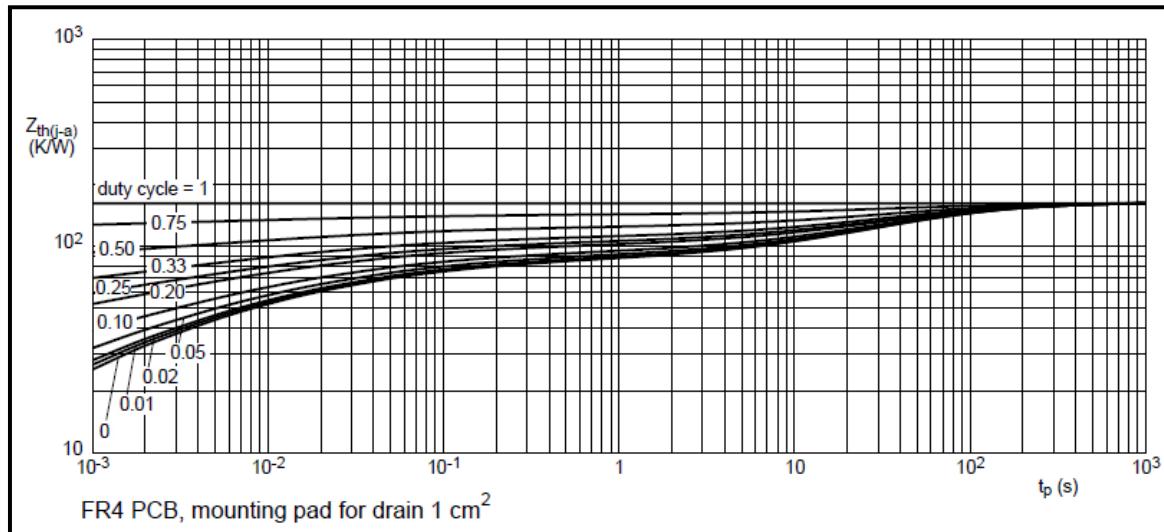
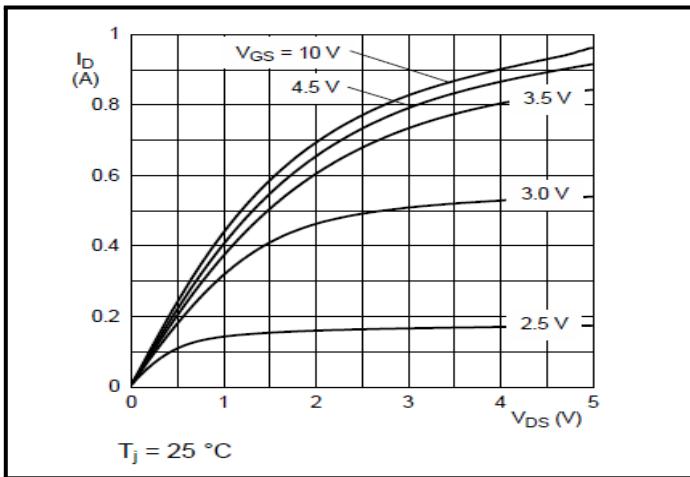


Figure 5: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

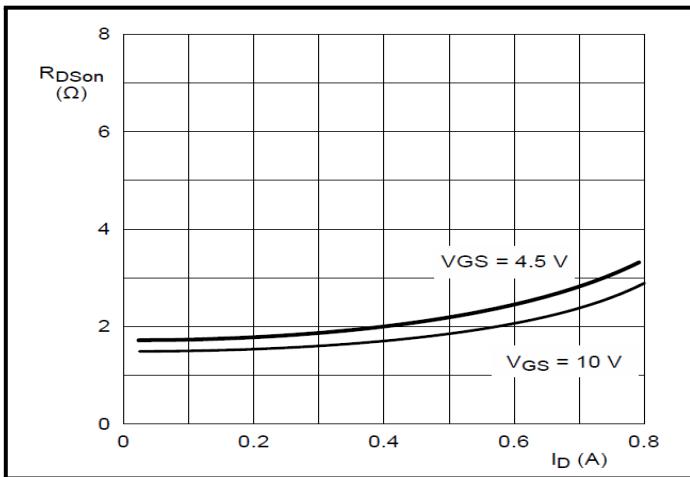


Typical Performance Characteristics ( $T_j = 25^\circ\text{C}$ , unless otherwise noted)

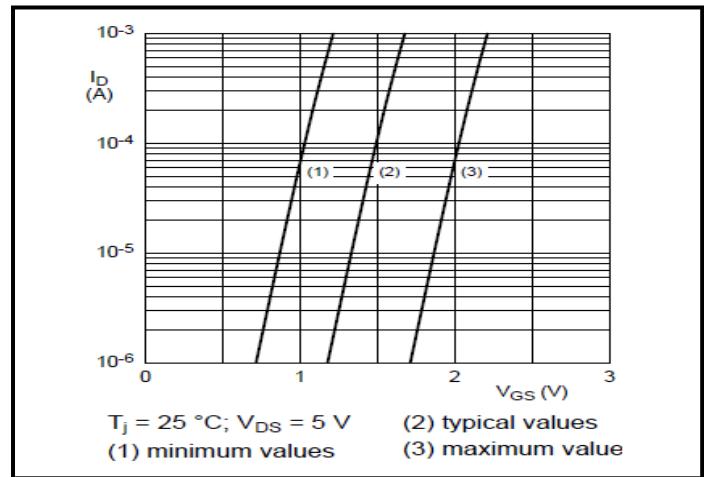
**Figure 6: Output characteristics: drain current as a function of drain-source voltage; typical values**



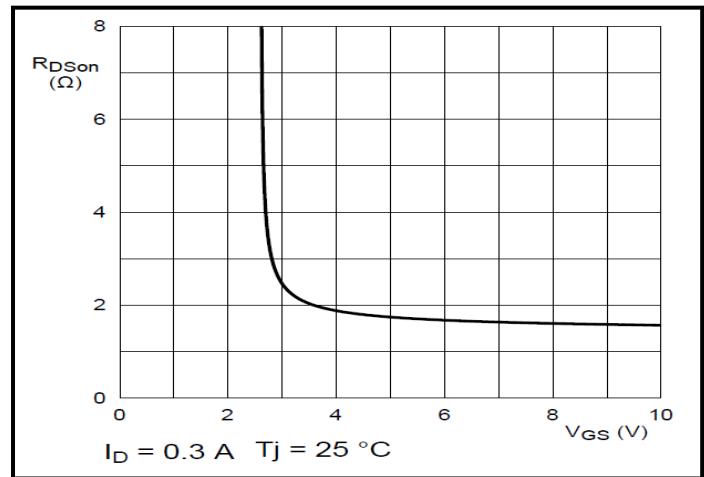
**Figure 8: Drain-source on-state resistance as a function of drain current; typical values**



**Figure 7: Sub-threshold drain current as a function of gate-source voltage**

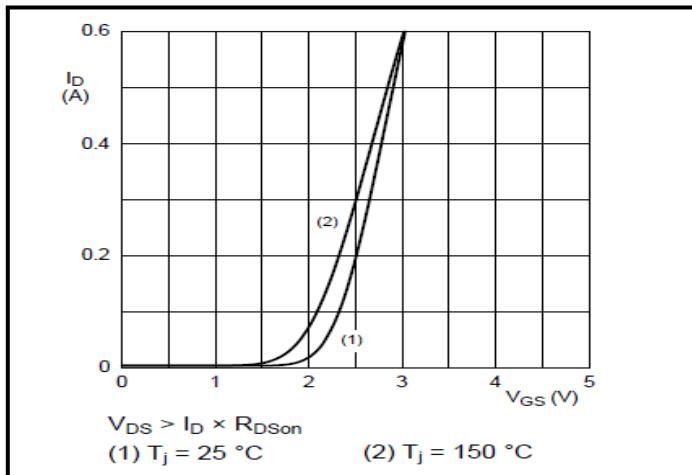


**Figure 9: Drain-source on-state resistance as a function of drain current; typical values**

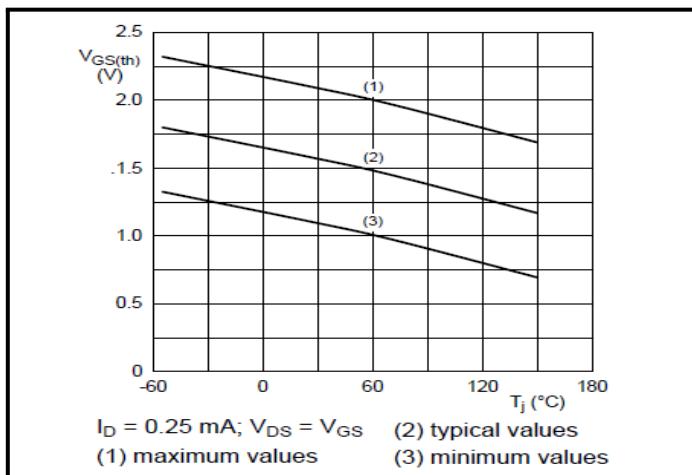


Typical Performance Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

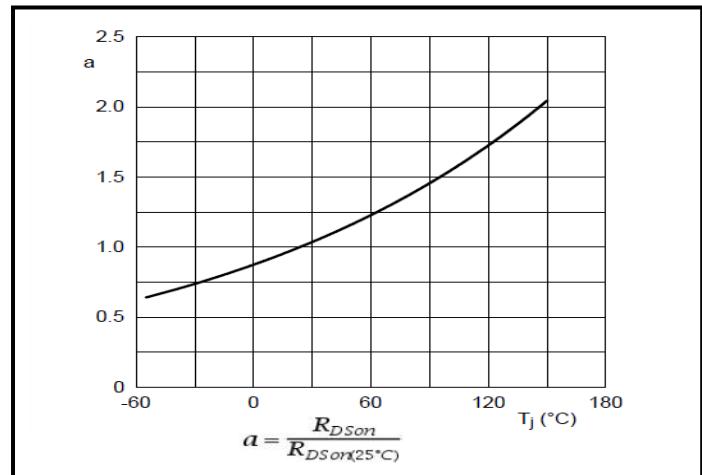
**Figure 10: Transfer characteristics: drain current as a function of gate-source voltage; typical values**



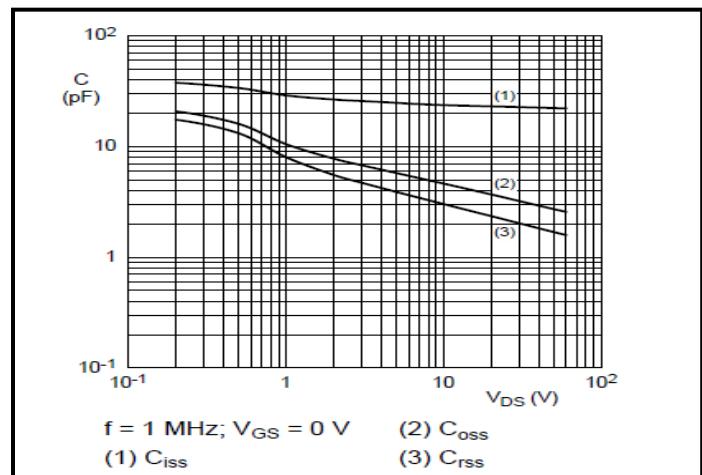
**Figure 12: Gate-source threshold voltage as a function of junction temperature**



**Figure 11: Normalized drain-source on-state resistance as a function of junction temperature; typical values**

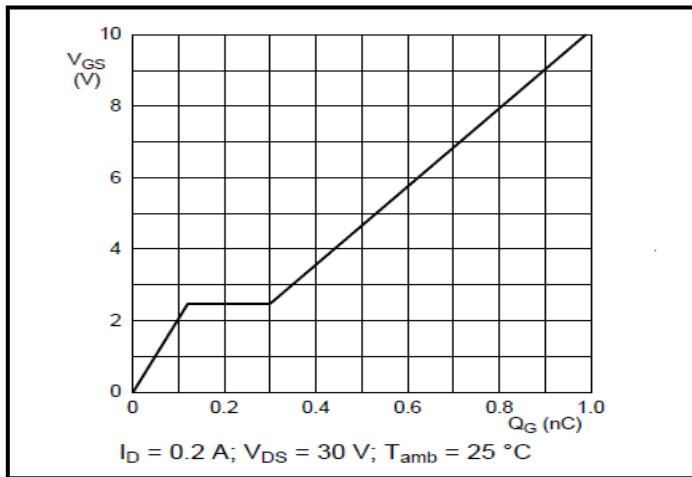


**Figure 13: Input, output and reverse transfer capacitances as a function of drain-source voltage**

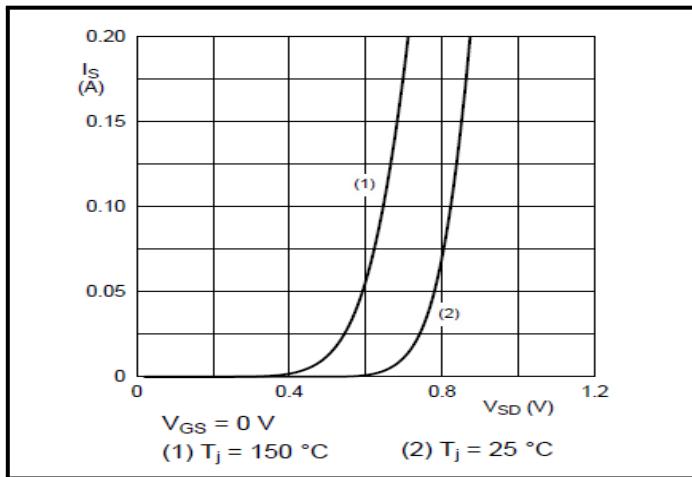


Typical Performance Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

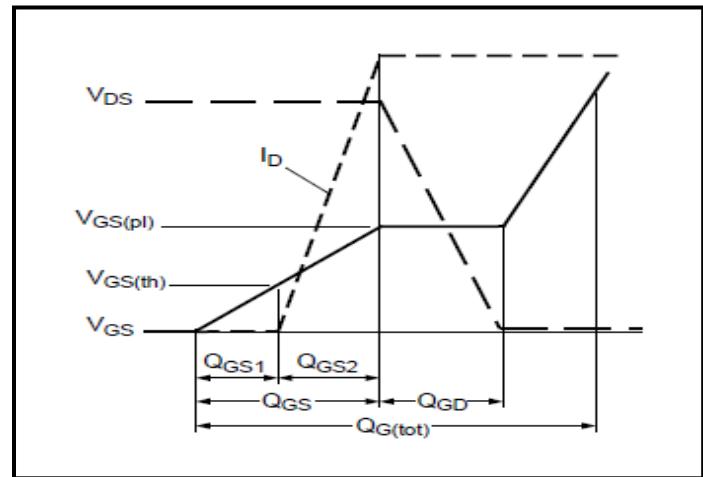
**Figure 14: Gate-source voltage as a function of gate charge; typical values**



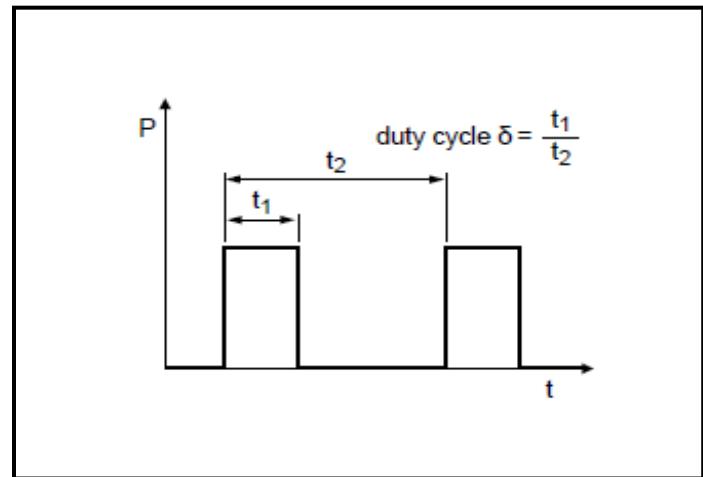
**Figure 16: Source current as a function of source-drain voltage; typical values**



**Figure 15: MOSFET transistor: Gate charge waveform definitions**



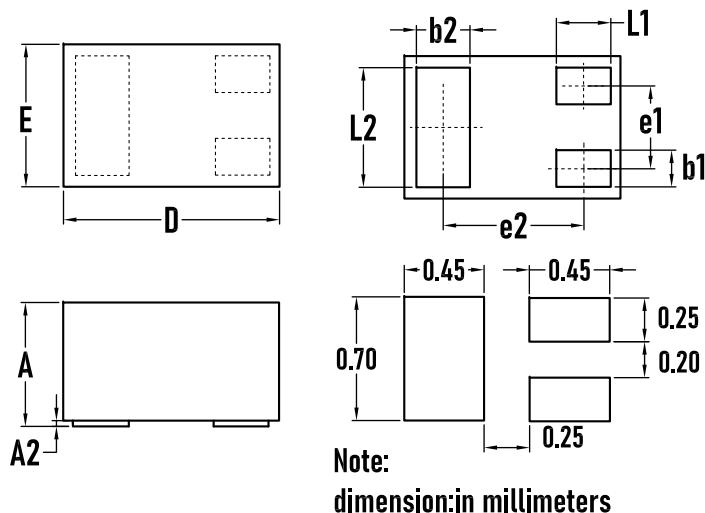
**Figure 17: Test information: Duty cycle definition**



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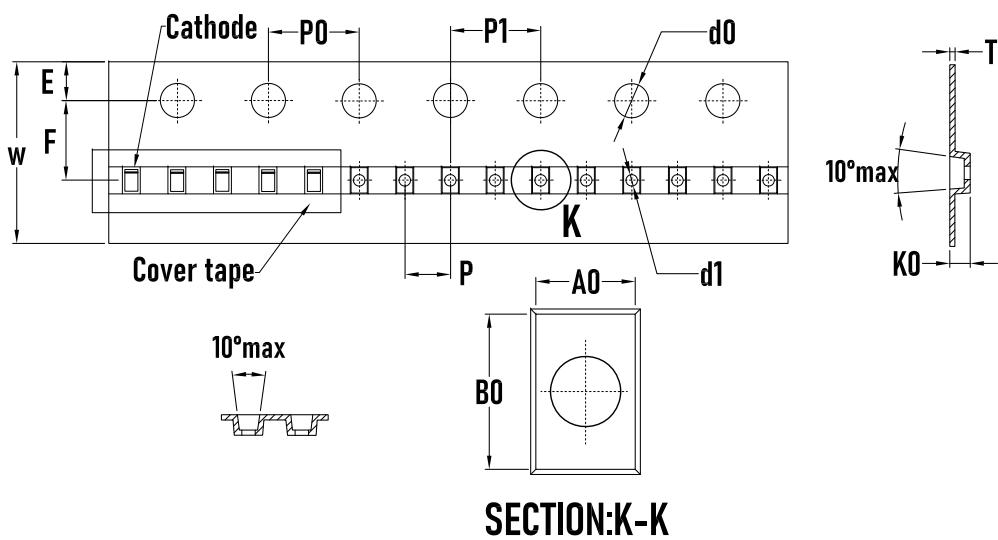
N-Channel MOSFET

## Outline Drawing -DFN1006-3L



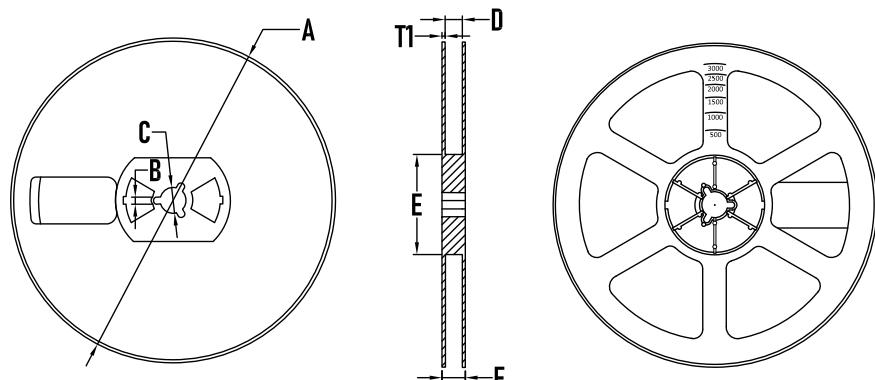
SYMBOL	MILLIMETER		
	MIN.	Typ.	MAX.
A	0.40	—	050
A2	0.00	—	.05
b1	0.10	0.15	0.20
b2	0.20	0.25	0.30
D	0.95	1.00	1.05
E	0.55	0.60	0.65
e1	0.350BSC		
e2	0.675BSC		
L1	0.20	0.30	0.40
L2	0.40	0.50	0.60

## Packaging Tape - DFN1006



SYMBOL	MILLIMETER
A0	0.71±0.05
B0	1.11±0.05
d0	1.5 <sup>+0.1</sup> <sub>-0</sub>
d1	0.50±0.05
E	1.75±0.10
F	3.50±0.05
K0	0.56±0.05
P	2.00±0.05
P0	4.00±0.10
P1	2.00±0.05
W	8.00 <sup>+0.03</sup> <sub>-0.01</sub>
T	0.2±0.015

## Packaging Reel



SYMBOL	MILLIMETER
A	178±1
B	3.5±0.2
C	14.3±0.2
D	9.8 <sup>+2</sup> <sub>-1</sub>
E	54.5±0.5
F	12.4±0.2
T1	1.0±0.2
Quantity	10000PCS

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