

N-Channel Enhancement Mode Power MOSFET

General Description

The series of Power MOSFETs use advanced technology and design. This high voltage MOSFET fits Switched applications.

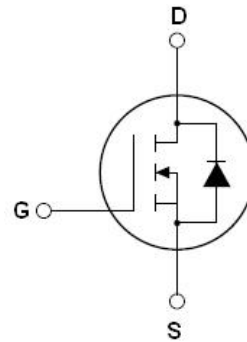
Features

- High speed switching
- Intrinsic capacitances and Qg minimized
- 100% Avalanche Tested

Application

- Switched applications

$V_{DS\ min@T_{jmax}}$	1850	V
$R_{DS(ON)TYP}$	6	Ω
I_D	2.9	A
Q_g	33	nC



Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
NCE3N170	TO-220	NCE3N170



TO-220

Table 1. Absolute Maximum Ratings ($T_J=25^\circ\text{C}$)

Parameter	Symbol	NCE3N170	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	1700	V
Gate-Source Voltage ($V_{DS}=0V$) DC	V_{GS}	± 30	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	2.9	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	2.03	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	8.7	A
Maximum Power Dissipation ($T_c=25^\circ\text{C}$)	P_D	187	W
Derate above 25°C		1.24	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	E_{AS}	210	mJ
Single pulse avalanche current (Note 2)	I_{AS}	2.9	A
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+175	$^\circ\text{C}$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	NCE3N170	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R_{thJC}	0.8	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Maximum)	R_{thJA}	50	$^{\circ}\text{C}/\text{W}$

Table 3. Electrical Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0\text{V}, I_D=1\text{mA}$	1700			V
Zero Gate Voltage Drain Current($T_c=25^{\circ}\text{C}$)	I_{DSS}	$V_{DS}=1700\text{V}, V_{GS}=0\text{V}$			1	μA
Zero Gate Voltage Drain Current($T_c=125^{\circ}\text{C}$)	I_{DSS}	$V_{DS}=1700\text{V}, V_{GS}=0\text{V}$			100	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 30\text{V}, V_{DS}=0\text{V}$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	3	4	5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}, I_D=1.45\text{A}$		6	8	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS}=40\text{V}, V_{GS}=0\text{V},$ $F=1.0\text{MHz}$		1700		pF
Output Capacitance	C_{oss}			60		pF
Reverse Transfer Capacitance	C_{rss}			3.3		pF
Total Gate Charge	Q_g	$V_{DS}=1350\text{V}, I_D=1.45\text{A},$ $V_{GS}=10\text{V}$		33		nC
Gate-Source Charge	Q_{gs}			7.7		nC
Gate-Drain Charge	Q_{gd}			14		nC
Intrinsic gate resistance	R_G	$f = 1 \text{ MHz open drain}$		2		Ω
Switching times						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=850\text{V}, I_D=1.45\text{A},$ $R_G=3\Omega, V_{GS}=10\text{V}$		22		nS
Turn-on Rise Time	t_r			8		nS
Turn-Off Delay Time	$t_{d(off)}$			48		nS
Turn-Off Fall Time	t_f			49		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	$T_C=25^{\circ}\text{C}$			2.9	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				8.7	A
Forward On Voltage	V_{SD}	$T_J=25^{\circ}\text{C}, I_{SD}=2.9\text{A}, V_{GS}=0\text{V}$		0.8	1.1	V
Reverse Recovery Time	t_{rr}	$T_J=25^{\circ}\text{C}, I_F=2.9\text{A},$ $di/dt=100\text{A}/\mu\text{s}$		1500		nS
Reverse Recovery Charge	Q_{rr}				5.6	μC
Peak Reverse Recovery Current	I_{rrm}				7.5	A

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

2. $T_J=25^{\circ}\text{C}, V_{DD}=50\text{V}, V_G=10\text{V}, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

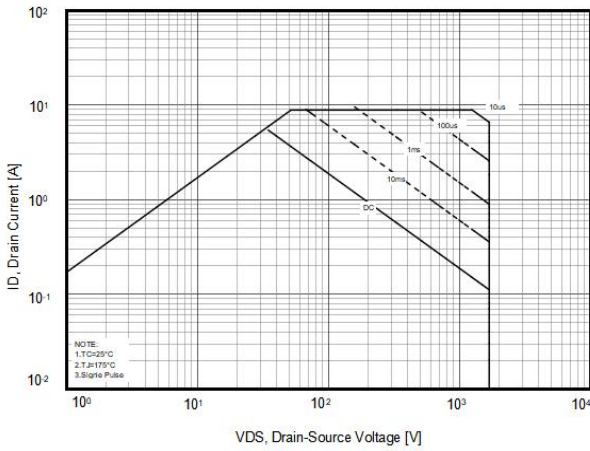


Figure2. Source-Drain Diode Forward Voltage

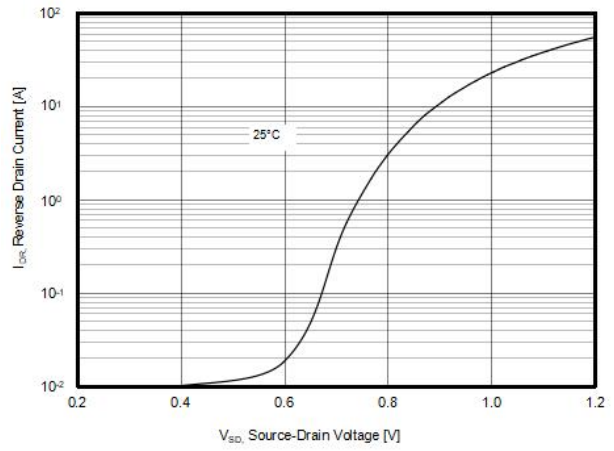


Figure3. R_{DS(ON)} vs Junction Temperature

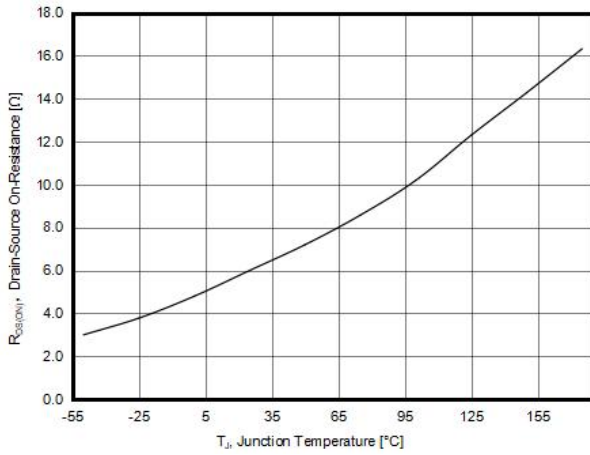


Figure4. BV_{DSS} vs Junction Temperature

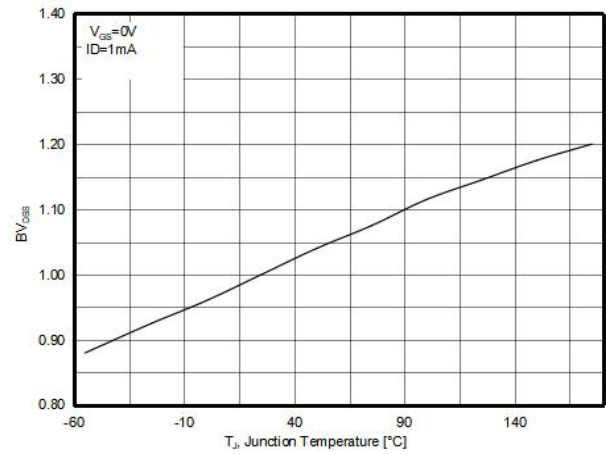


Figure5. Maximum ID vs Junction Temperature

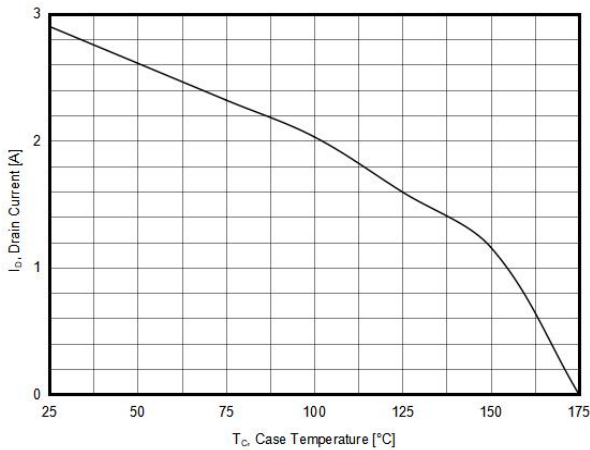


Figure6. Output characteristics

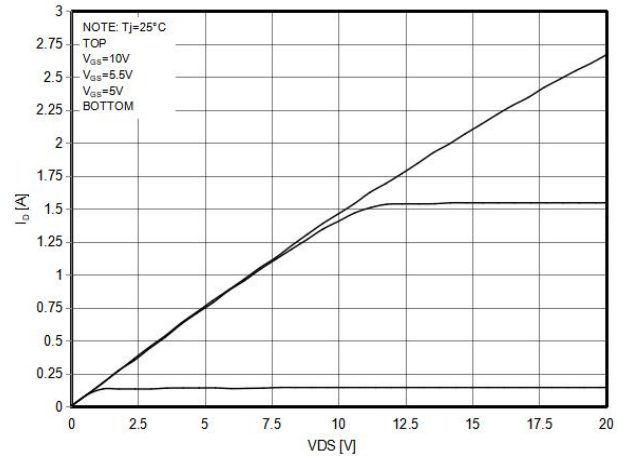


Figure7. Capacitance

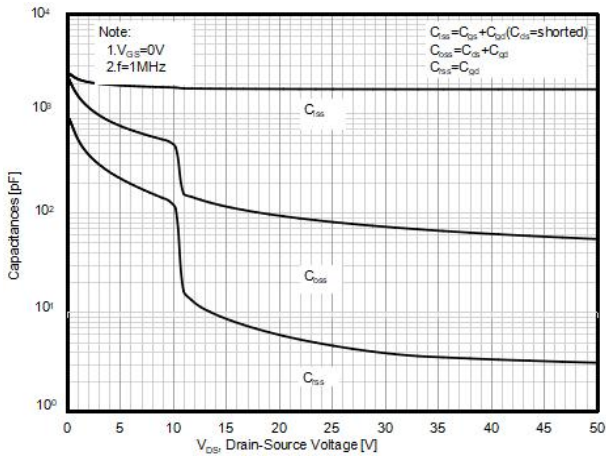


Figure8. Transfer characteristics

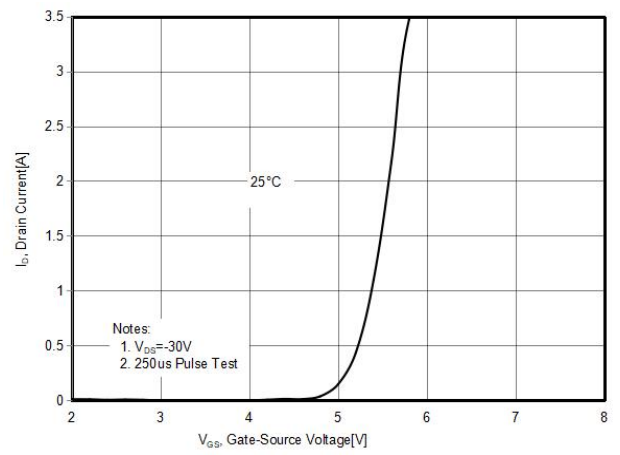


Figure9. Static drain-source on resistance

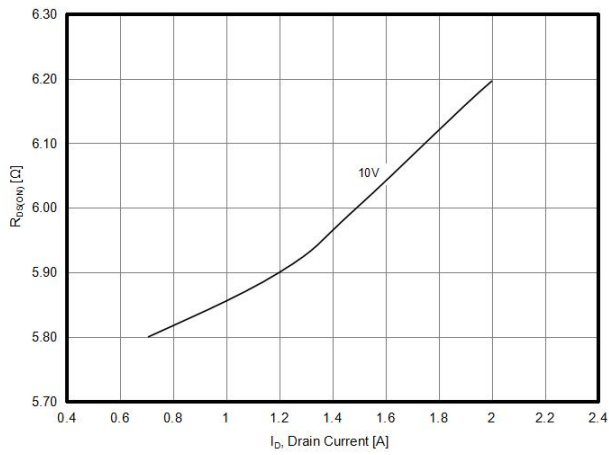
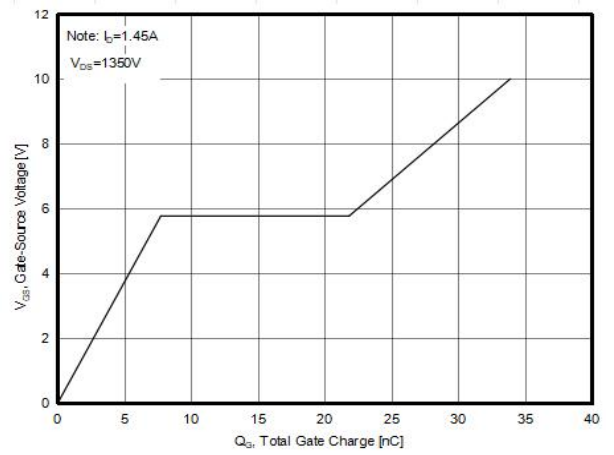


Figure9. Gate charge waveforms

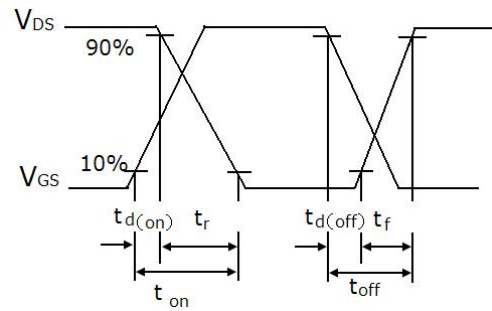


Test circuit

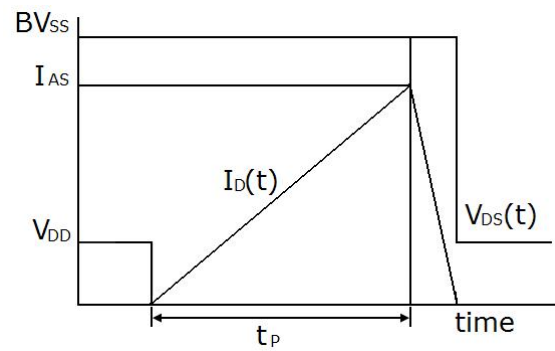
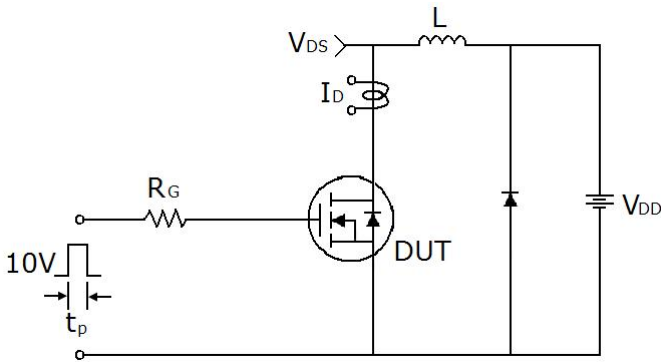
1) Gate charge test circuit & Waveform



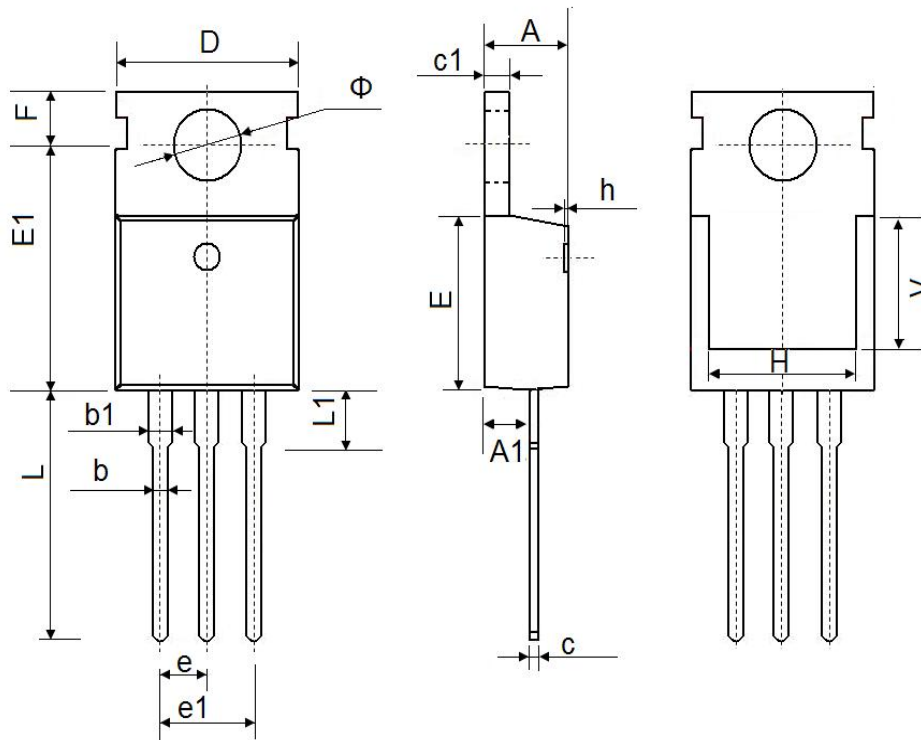
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

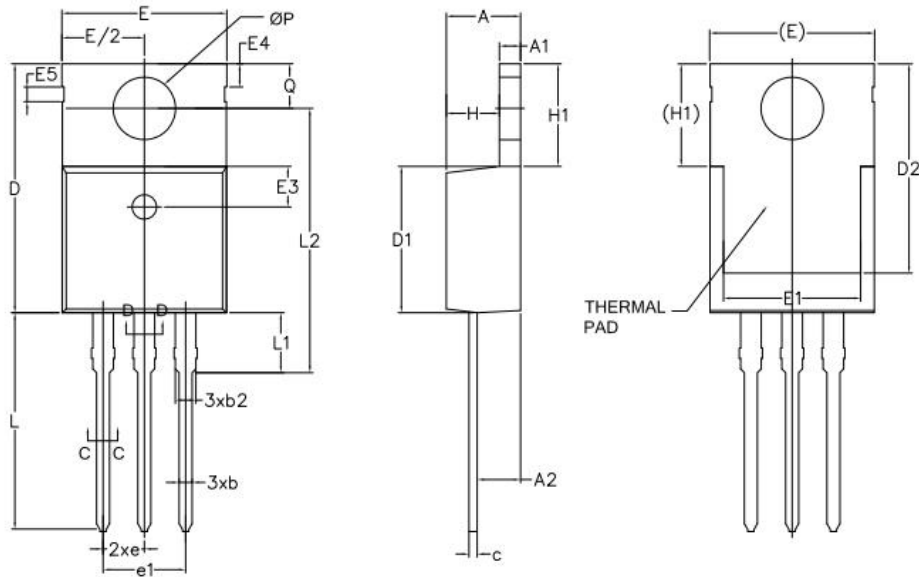


TO-220-E Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.20	4.60	0.165	0.181
A1	2.25	2.55	0.089	0.100
b	0.70	0.90	0.028	0.035
b1	1.17	1.37	0.046	0.054
c	0.33	0.65	0.013	0.026
c1	1.20	1.40	0.047	0.055
D	9.91	10.25	0.390	0.404
E	8.95	9.75	0.352	0.384
E1	12.80	12.90	0.504	0.508
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
F	2.65	2.95	0.104	0.116
H	7.90	8.10	0.311	0.319
L	12.90	13.40	0.508	0.528
L1	2.85	3.25	0.112	0.128
φ	3.40	3.80	0.134	0.150

TO-220-J Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.47	4.67	0.176	0.184
A1	1.20	1.40	0.047	0.055
A2	2.35	2.90	0.093	0.114
b	0.71	0.91	0.028	0.036
b1	0.71	0.86	0.028	0.034
b2	1.22	1.36	0.048	0.054
c	0.47	0.60	0.019	0.024
c1	0.47	0.55	0.019	0.022
D	14.70	15.80	0.579	0.622
D1	8.90	9.47	0.350	0.373
D2	11.75	13.60	0.463	0.535
E	9.70	10.37	0.382	0.408
E1	7.00	8.89	0.276	0.350
E2	9.80	10.20	0.386	0.402
E3	2.40	2.60	0.094	0.102
E4	1.27	1.57	0.050	0.062
e	2.54BSC		0.100BSC	
e1	5.08BSC		0.200BSC	
H	3.00	3.40	0.118	0.134
L	12.90	14.80	0.508	0.583
L1	2.54	3.84	0.100	0.151
L2	12.13	16.50	0.478	0.650
ΦP	3.60	3.90	0.142	0.154
Q	4.60	4.90	0.181	0.193

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