

NCE N-Channel Enhancement Mode Power MOSFET

Description

The NCE0157A2 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

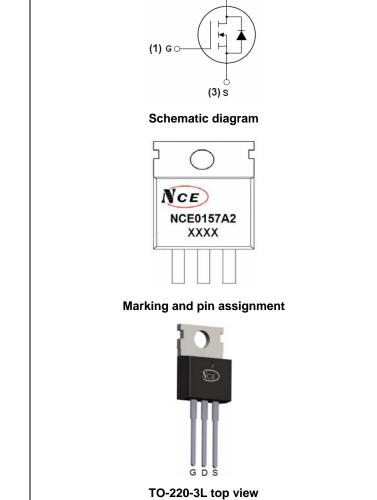
- $V_{DS} = 100V, I_D = 57A$ $R_{DS(ON)} < 17.5m\Omega @ V_{GS} = 10V$ (Typ:14.5m Ω)
- Special process technology for high ESD capability
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

100% UIS TESTED!

100% ΔVds TESTED!



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Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE0157A2	NCE0157A2	TO-220-3L	-	-	-

Absolute Maximum Ratings (T_c=25[°]C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	Vds	100	V
Gate-Source Voltage	Vgs	±20	V
Drain Current-Continuous	Ι _D	57	А
Drain Current-Continuous(T _C =100℃)	I _D (100℃)	40	А
Pulsed Drain Current	I _{DM}	160	А
Maximum Power Dissipation	PD	160	W
Derating factor	-	1.06	W/°C
Single pulse avalanche energy (Note 5)	E _{AS}	580	mJ





NCE0157A2

Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	°C

Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{ ext{ heta}JC}$	0.94	°C/W
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Electrical Characteristics (T_c=25°C unless otherwise noted)

$\begin{array}{ c c c c c } \hline Off Characteristics \\ \hline Drain-Source Breakdown Voltage BV_{DS} & V_{GS}=0V I_D=250 \mu A & 100 & 110 & - \\ \hline Zero Gate Voltage Drain Current I_{DSS} & V_{DS}=100V, V_{GS}=0V & - & - & 1 \\ \hline Gate-Body Leakage Current I_{GSS} & V_{GS}=\pm20V, V_{DS}=0V & - & - & \pm100 \\ \hline On Characteristics ^{(Note 3)} & \\ \hline Gate Threshold Voltage & V_{GS(th)} & V_{DS}=V_{GS}, I_D=250 \mu A & 2 & 3 & 4 \\ \hline Drain-Source On-State Resistance & R_{DS(ON)} & V_{GS}=10V, I_D=28A & - & 14.5 & 17.5 \\ \hline Forward Transconductance & G_{FS} & V_{DS}=25V, I_D=28A & 32 & - & - \\ \hline Dynamic Characteristics ^{(Note 4)} & & \\ Input Capacitance & C_{Iss} & V_{DS}=25V, V_{GS}=0V, \\ \hline Cutput Capacitance & C_{Iss} & V_{DS}=25V, V_{GS}=0V, \\ \hline Reverse Transfer Capacitance & C_{rss} & F=1.0MHz & - & 182.5 & - \\ \hline Switching Characteristics ^{(Note 4)} & & \\ Turn-on Delay Time & t_{q(on)} & V_{DD}=30V, I_D=2A, R_L=15\Omega & - & \\ \hline Turn-Onf Delay Time & t_{q(off)} & V_{DS}=30V, I_D=30A, \\ \hline Turn-Off Fall Time & t_{f} & \\ \hline Total Gate Charge & Q_{g} & V_{OS}=10V & & - & \\ \hline Case Source Charge & Q_{gd} & V_{OS}=10V & - & 57.1 & - \\ \hline Drain-Source Diode Characteristics \\ \hline Diode Forward Voltage (^{Note 3}) & V_{SD} & V_{GS}=0V, I_S=28A & - & 0.85 & 1.2 \\ \hline \end{array}$	Unit	Мах	Тур	Min	Condition	Parameter Symbol Condition	
$ \begin{array}{ c c c c } \hline Zero Gate Voltage Drain Current & I_{DSS} & V_{DS}=100V, V_{GS}=0V & - & 1 & 1 \\ \hline Gate-Body Leakage Current & I_{GSS} & V_{GS}=\pm 20V, V_{DS}=0V & - & \pm 100 \\ \hline On Characteristics (^{Nole 3}) & \\ \hline Gate Threshold Voltage & V_{GS(fh)} & V_{DS}=V_{GS}, I_D=250 \mu A & 2 & 3 & 4 & \\ \hline Drain-Source On-State Resistance & R_{DS(ON)} & V_{GS}=10V, I_D=28A & - & 14.5 & 17.5 & \\ \hline Forward Transconductance & g_{FS} & V_{DS}=25V, I_D=28A & 32 & - & \\ \hline Dynamic Characteristics (^{Nole 4)} & & \\ \hline Unput Capacitance & C_{ISS} & V_{DS}=25V, V_{GS}=0V, \\ \hline Coutput Capacitance & C_{rss} & & \\ \hline Switching Characteristics (^{Nole 4)} & & \\ \hline Turn-on Delay Time & t_{d(on)} & & \\ Turn-Off Delay Time & t_{d(onf)} & & \\ \hline Turn-Off Delay Time & t_{d(onf)} & & \\ \hline Turn-Off Fall Time & t_{t} & \\ \hline Total Gate Charge & Q_{g} & \\ \hline Cust & Q_{gs} = 10V, I_D=30A, \\ \hline Gate Charge & Q_{gs} & \\ \hline Cust & Q_{gs} = 10V & \\ \hline Cust & Q_{GS}=10V & \\ \hline Cust & Q_{GS} = 10V & \\ \hline Cust & Q_{GS} & \\ \hline Cust & Q_{SS} = 0V, I_S=28A & \\ \hline Cust & Q_{SS} & \\ \hline Cust & \\ \hline Cust & Q_{SS} & \\ \hline Cust & Q_{SS} & \\ \hline Cust & \\ \hline Cust & Q_{SS} & \\ \hline Cust & \\ \hline Cust & \\ \hline Cust & Q_{SS} & \\ \hline Cust & \\ \hline Cu$							Off Characteristics
Gate-Body Leakage Current IGSS $V_{GS}=\pm 20V, V_{DS}=0V$ - ± 100 On Characteristics (Note 3) Gate Threshold Voltage $V_{GS}(th)$ $V_{DS}=V_{GS}, I_D=250 \mu A$ 2 3 4 Drain-Source On-State Resistance $R_{DS}(ON)$ $V_{GS}=10V, I_D=28A$ - 14.5 17.5 Forward Transconductance g_{FS} $V_{DS}=25V, I_D=28A$ 32 - - Dynamic Characteristics (Note4) $V_{DS}=25V, V_{GS}=0V, F=10MHz$ - 3969 - Output Capacitance C_{ISS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 182.5 - Reverse Transfer Capacitance C_{rss} $V_{DS}=30V, I_D=2A, R_L=15\Omega, F=1.0MHz$ - 160.2 - Switching Characteristics (Note 4) Turn-on Rise Time tr $V_{DD}=30V, I_D=2A, R_L=15\Omega, F=1.0MHz$ - 13 - Turn-Off Delay Time tdq(off) $V_{DS}=10V, R_G=2.5\Omega, F=1.0M, R_G=2.$	V	-	110	100	V _{GS} =0V I _D =250µA	BV _{DSS}	Drain-Source Breakdown Voltage
On Characteristics (Note 3) V _{GS} (th) V _{DS} =V _{GS} ,Ib=250µA 2 3 4 Gate Threshold Voltage R _{DS} (ON) V _{GS} =10V, Ib=28A - 14.5 17.5 Forward Transconductance g _{FS} V _{DS} =25V,Ib=28A 32 - - Dynamic Characteristics (Note4) 3969 - Input Capacitance C _{Iss} V _{DS} =25V,V _{GS} =0V, F=1.0MHz 182.5 - Output Capacitance C _{Iss} V _{DS} =25V,V _{GS} =0V, F=1.0MHz 182.5 - Reverse Transfer Capacitance C _{rss} V _{DS} =25V,V _{GS} =0V, F=1.0MHz 180.2 - Switching Characteristics (Note 4) - 182.5 - Turn-on Delay Time td(on) V _{DS} =30V,Ib=2A,RL=15Ω - 160.2 - Turn-Off Delay Time td(off) V _{DS} =30V,Ib=2A,RL=15Ω - 13 - Turn-Off Fall Time t - 16 - - - 16 - Gate-Source Charge Q _g V _{DS} =30V,Ib=30A, V _{GS} =10V	μA	1	-	-	V _{DS} =100V,V _{GS} =0V	I _{DSS}	Zero Gate Voltage Drain Current
Gate Threshold Voltage $V_{GS(th)}$ $V_{DS}=V_{GS}, I_D=250\muA$ 2 3 4 Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS}=10V, I_D=28A$ 32 - - Forward Transconductance g_{FS} $V_{DS}=25V, I_D=28A$ 32 - - Dynamic Characteristics (Note4) C_{ISS} $V_{DS}=25V, V_{GS}=0V, F=10MHz$ 3969 - Output Capacitance C_{OSS} $F=1.0MHz$ - 182.5 - Reverse Transfer Capacitance C_{rss} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ - 182.5 - Switching Characteristics (Note 4) C_{rss} $V_{DS}=30V, I_D=2A, R_L=150$ - 14.5 - Turn-on Delay Time $t_{d(on)}$ $V_{SS}=10V, R_{S}=2.5\Omega$ - 13 - Turn-Off Delay Time $t_{d(off)}$ $V_{DS}=30V, I_D=2A, R_L=15\Omega$ - 16 - Turn-Off Fall Time $t_{d(off)}$ $V_{DS}=30V, I_D=30A, V_{GS}=10V$ - 16 - Gate-Source Charge Q_{g} $V_{GS}=10V$ -	nA	±100	-	-	V _{GS} =±20V,V _{DS} =0V	I _{GSS}	Gate-Body Leakage Current
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$							On Characteristics (Note 3)
Forward Transconductance g_{FS} $V_{DS}=25V, I_D=28A$ 32 $-$ Dynamic Characteristics (Note4) $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ $ 3969$ $-$ Input Capacitance C_{OSS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ $ 182.5$ $-$ Output Capacitance C_{OSS} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ $ 182.5$ $-$ Reverse Transfer Capacitance C_{rss} $V_{DS}=25V, V_{GS}=0V, F=1.0MHz$ $ 182.5$ $-$ Switching Characteristics (Note 4) $F=1.0MHz$ $ 160.2$ $-$ Turn-on Delay Time $t_{d(on)}$ $V_{DD}=30V, I_D=2A, R_L=15\Omega$ $ 13$ $-$ Turn-Off Delay Time $t_d(off)$ $V_{SS}=10V, R_G=2.5\Omega$ $ 146.1$ $-$ Turn-Off Fall Time t_f $V_{DS}=30V, I_D=30A, V_{GS}=10V$ $ 146.1$ $-$ Gate-Drain Charge Q_{gd} $V_{GS}=10V$ $ 57.1$ $-$ Diode Forward Voltage (Note 3) V_{SD} $V_{GS}=0V, I_S=28A$ $ 0$	V	4	3	2	V _{DS} =V _{GS} ,I _D =250µA	V _{GS(th)}	Gate Threshold Voltage
Dynamic Characteristics (Note4)ClassVDS = 25V, VGS = 0V, F = 1.0MHz-3969-Output CapacitanceCoss $V_{DS} = 25V, V_{GS} = 0V,$ F = 1.0MHz-182.5-Reverse Transfer CapacitanceCrss C_{rss} -160.2-Switching Characteristics (Note 4)Turn-on Delay Time $t_{d(on)}$ -17-Turn-on Rise Timetr $V_{DD} = 30V, I_D = 2A, R_L = 15\Omega$ -13-Turn-Off Delay Time $t_{d(off)}$ $V_{GS} = 10V, R_G = 2.5\Omega$ -16-Turn-Off Fall Timetr-16Total Gate ChargeQg $V_{DS} = 30V, I_D = 30A,$ $V_{GS} = 10V$ -146.1-Gate-Drain ChargeQgs $V_{GS} = 10V$ -57.1-Diode Forward Voltage (Note 3) V_{SD} $V_{GS} = 0V, I_S = 28A$ -0.851.2	mΩ	17.5	14.5	-	V _{GS} =10V, I _D =28A	R _{DS(ON)}	Drain-Source On-State Resistance
$ \begin{array}{ c c c c c } \hline \mbox{Input Capacitance} & C_{1ss} & V_{DS}=25V, V_{GS}=0V, \\ \hline \mbox{F}=1.0MHz & - & 182.5 & - & \\ \hline \mbox{Input Capacitance} & C_{rss} & F=1.0MHz & - & 182.5 & - & \\ \hline \mbox{Input Capacitance} & C_{rss} & F=1.0MHz & - & 160.2 & - & \\ \hline \mbox{Switching Characteristics}^{(Note 4)} & & & & & & \\ \hline \mbox{Switching Characteristics}^{(Note 4)} & & & & & & & & \\ \hline \mbox{Iurn-on Delay Time} & t_{d(on)} & & & & & & & & & \\ \hline \mbox{Iurn-on Rise Time} & tr & & V_{DD}=30V, I_{D}=2A, R_{L}=15\Omega & - & & & & & \\ \hline \mbox{Iurn-Off Delay Time} & t_{d(off)} & & & & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & tr & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & & \\ \hline \mbox{Iurn-Off Fall Time} & & & & & \\ \hline Iurn-Off Fall Tim$	S	-	-	32	V _{DS} =25V,I _D =28A	g fs	Forward Transconductance
$ \begin{array}{ c c c c c } \hline & & & & & & & & & & & & & & & & & & $							Dynamic Characteristics (Note4)
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	PF	-	3969	-		C _{lss}	Input Capacitance
Reverse Transfer Capacitance C_{rss} - 160.2 - Switching Characteristics (Note 4) - 160.2 - Turn-on Delay Time $t_{d(on)}$ $V_{DD}=30V, I_D=2A, R_L=15\Omega$ - 13 - Turn-on Rise Time $t_{d(off)}$ $V_{DD}=30V, I_D=2A, R_L=15\Omega$ - 13 - Turn-Off Delay Time $t_{d(off)}$ $V_{GS}=10V, R_G=2.5\Omega$ - 160.2 - Turn-Off Fall Time t_f $V_{DS}=30V, I_D=30A, V_{DS}=30V, I_D=30A, V_{GS}=10V$ - 146.1 - Gate-Source Charge Q_{gd} $V_{GS}=10V$ - 29.3 - Diade Forward Voltage (Note 3) V_{SD} $V_{GS}=0V, I_S=28A$ - 0.85 1.2	PF	-	182.5	-		C _{oss}	Output Capacitance
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	PF	-	160.2	-		C _{rss}	Reverse Transfer Capacitance
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $							Switching Characteristics (Note 4)
$ \begin{array}{c c c c c c c } \hline Turn-Off Delay Time & t_{d(off)} & V_{GS}=10V, R_G=2.5\Omega & - & 55 & - \\ \hline Turn-Off Fall Time & t_{f} & & - & 16 & - \\ \hline Total Gate Charge & Q_{g} & & & & & & & & \\ \hline Total Gate Charge & Q_{gs} & & & & & & & & & & & \\ \hline Gate-Source Charge & Q_{gd} & & & & & & & & & & & & & & & \\ \hline Gate-Drain Charge & Q_{gd} & & & & & & & & & & & & & & & & & \\ \hline Drain-Source Diode Characteristics & & & & & & & & & & & & & & & \\ \hline Diode Forward Voltage^{(Note 3)} & V_{SD} & V_{SD} & V_{GS}=0V, I_{S}=28A & - & 0.85 & 1.2 \\ \hline \end{array} $	nS	-	17	-		t _{d(on)}	Turn-on Delay Time
Turn-Off Fall Time tr - 16 - Total Gate Charge Qg VDS=30V,ID=30A, VGS=10V - 146.1 - Gate-Source Charge Qgs VGS=10V - 29.3 - Gate-Drain Charge Qgd - 57.1 - Drain-Source Diode Characteristics VSD VGS=0V,IS=28A - 0.85 1.2	nS	-	13	-	V_{DD} =30V, I_D =2A, R_L =15 Ω	tr	Turn-on Rise Time
Total Gate Charge Q_g $V_{DS}=30V,I_D=30A,$ $V_{GS}=10V$ -146.1-Gate-Source Charge Q_{gs} $V_{GS}=10V$ -29.3-Gate-Drain Charge Q_{gd} $V_{GS}=10V$ -57.1-Drain-Source Diode CharacteristicsDiode Forward Voltage (Note 3) V_{SD} $V_{GS}=0V,I_S=28A$ -0.851.2	nS	-	55	-	V _{GS} =10V,R _G =2.5Ω	t _{d(off)}	Turn-Off Delay Time
Gate-Source Charge Qgs VDS=30V,ID=30A, VGS=10V - 29.3 - Gate-Drain Charge Qgd VGS=10V - 57.1 - Drain-Source Diode Characteristics VSD VGS=0V,IS=28A - 0.85 1.2	nS	-	16	-		t _f	Turn-Off Fall Time
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	nC	-	146.1	-	\/20\/↓_20A	Qg	Total Gate Charge
Gate-Drain Charge Q _{gd} - 57.1 - Drain-Source Diode Characteristics V VGS=0V,IS=28A - 0.85 1.2	nC	-	29.3	-		Q _{gs}	Gate-Source Charge
Diode Forward Voltage (Note 3) V _{SD} V _{GS} =0V,I _S =28A - 0.85 1.2	nC	-	57.1	-	V _{GS} =10V	Q _{gd}	Gate-Drain Charge
			· ·				Drain-Source Diode Characteristics
	V	1.2	0.85	-	V _{GS} =0V,I _S =28A	V _{SD}	Diode Forward Voltage (Note 3)
Diode Forward Current ^(Note 2) Is 57	А	57	-	-		Is	Diode Forward Current (Note 2)
Reverse Recovery Time t_{rr} TJ = 25°C, IF = 28A-35-	nS	-	35	-	TJ = 25°C, IF = 28A	t _{rr}	Reverse Recovery Time
Reverse Recovery Charge Qrr di/dt = 100A/µs ^(Note3) - 58 -	nC	-	58	-	di/dt = 100A/µs ^(Note3)	Qrr	Reverse Recovery Charge
Forward Turn-On Time t _{on} Intrinsic turn-on time is negligible (turn-on is dominated by	/LS+LD)	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LE					Forward Turn-On Time

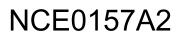
Notes:

- 1. Repetitive Rating: Pulse width limited by maximum junction temperature.
- **2.** Surface Mounted on FR4 Board, $t \le 10$ sec.
- **3.** Pulse Test: Pulse Width \leq 300µs, Duty Cycle \leq 2%.
- 4. Guaranteed by design, not subject to production
- 5. EAS condition: Tj=25 $^\circ\!\!\mathbb{C},V_{DD}$ =50V, V_G =10V,Rg=25 Ω , L=1mH, I_{AS}=35A

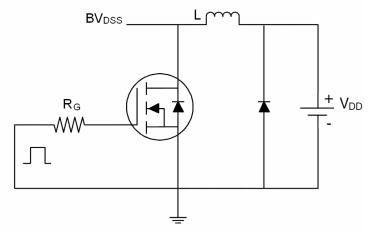


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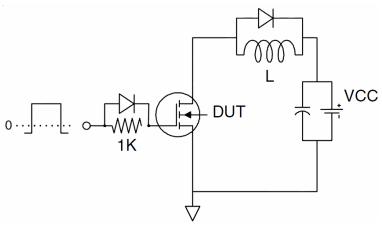




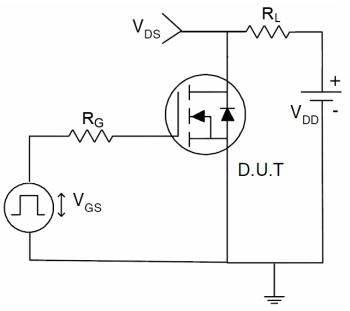
Test Circuit 1) E_{AS} test Circuit



2) Gate charge test Circuit



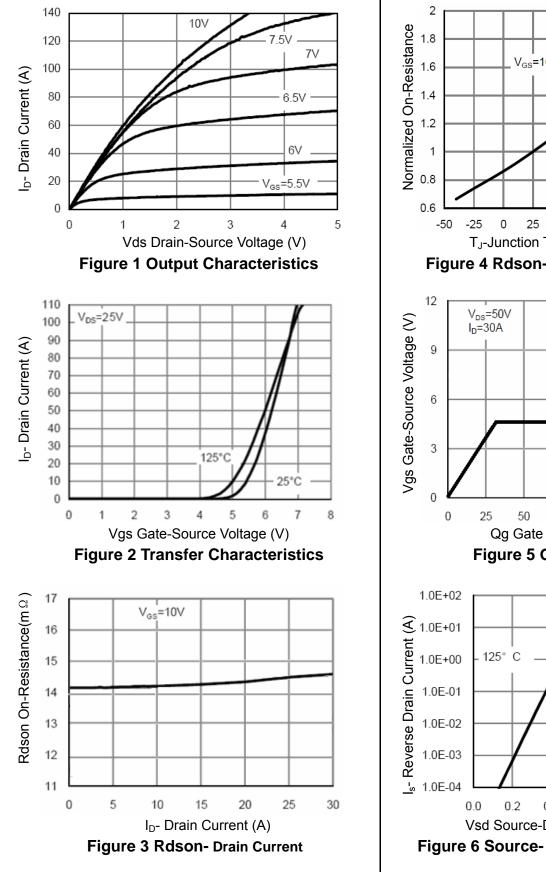
3) Switch Time Test Circuit

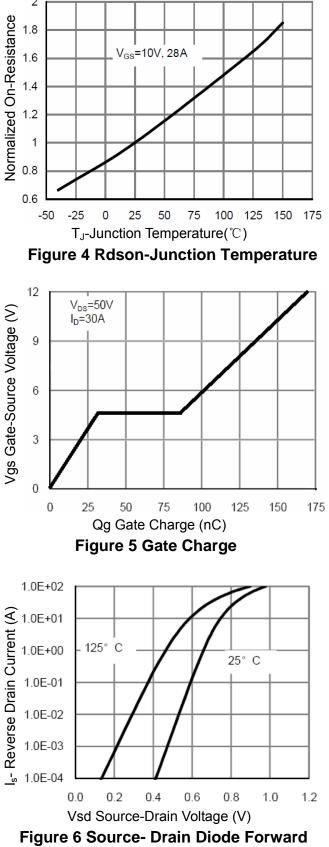






Typical Electrical and Thermal Characteristics (Curves)









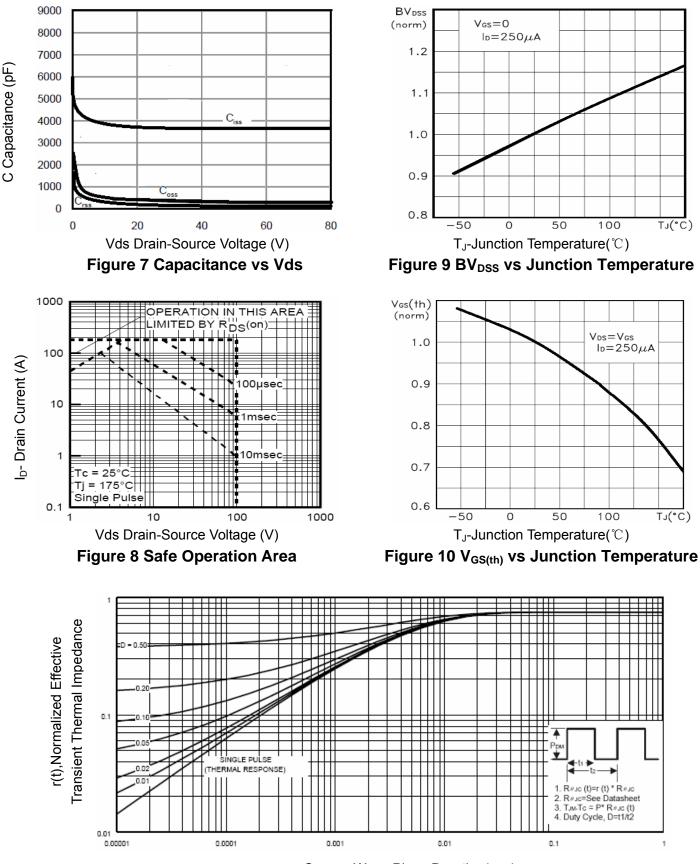
100

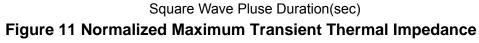
I₀=250µA

100

TJ(°C)

TJ(°C)

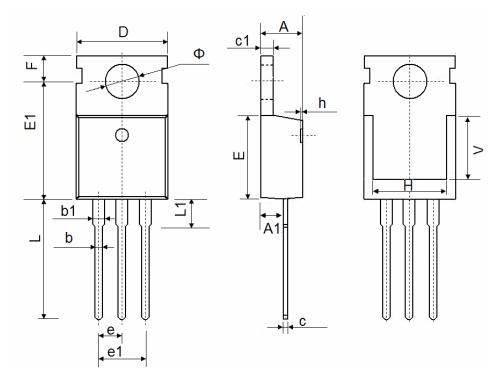








TO-220-3L Package Information



Symbol	Dimensions	In Millimeters	Dimensions In Inches	
Symbol	Min.	Max.	Min.	Max.
А	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
С	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
е	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
Н	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295	REF.
Φ	3.400	3.800	0.134	0.150







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