

## 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

$V_{DS\ min@T_{jmax}}$	1650	V
$R_{DS(ON)TYP}$	5.5	$\Omega$
$I_D$	3	A
$Q_g$	32	nC



Schematic diagram

### Package Marking And Ordering Information

Device	Device Package	Marking
NCE3N150T	TO-247	NCE3N150T



TO-247

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	1500	V
Gate-Source Voltage ( $V_{DS}=0V$ ) DC	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	3	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	2.1	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	9	A
Maximum Power Dissipation ( $T_c=25^\circ\text{C}$ )	$P_D$	187	W
Derate above $25^\circ\text{C}$		1.24	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note 2)	$E_{AS}$	225	mJ
Single pulse avalanche current (Note 2)	$I_{AS}$	3	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	Value	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)**

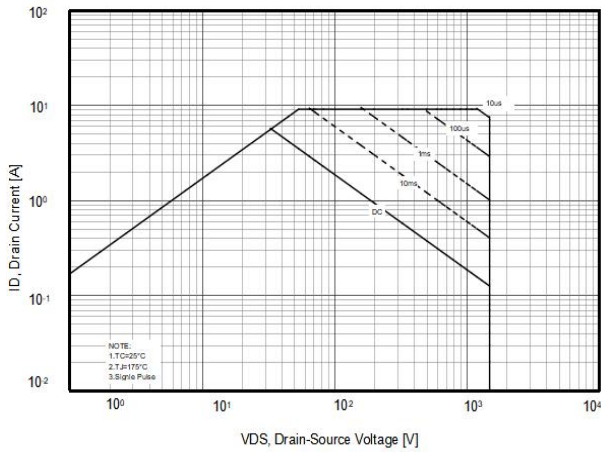
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/off states</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=1\text{mA}$	1500			V
Zero Gate Voltage Drain Current( $T_c=25^{\circ}\text{C}$ )	$I_{DSS}$	$V_{DS}=1500V, V_{GS}=0V$			1	$\mu\text{A}$
Zero Gate Voltage Drain Current( $T_c=125^{\circ}\text{C}$ )	$I_{DSS}$	$V_{DS}=1500V, V_{GS}=0V$			100	$\mu\text{A}$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 30V, V_{DS}=0V$			$\pm 100$	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	$R_{DS(ON)}$	$V_{GS}=10V, I_D=1.5A$		5.5	7.5	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=40V, V_{GS}=0V,$ $F=1.0\text{MHz}$		1700		pF
Output Capacitance	$C_{oss}$			61		pF
Reverse Transfer Capacitance	$C_{rss}$			5.5		pF
Total Gate Charge	$Q_g$	$V_{DS}=1200V, I_D=1.5A,$ $V_{GS}=10V$		32		nC
Gate-Source Charge	$Q_{gs}$			8.7		nC
Gate-Drain Charge	$Q_{gd}$			12		nC
Intrinsic gate resistance	$R_G$	$f = 1\text{MHz open drain}$		2		$\Omega$
<b>Switching times</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=750V, I_D=1.5A,$ $R_G=3\Omega, V_{GS}=10V$		22		nS
Turn-on Rise Time	$t_r$			45		nS
Turn-Off Delay Time	$t_{d(off)}$			42		nS
Turn-Off Fall Time	$t_f$			58		nS
<b>Source- Drain Diode Characteristics</b>						
Source-drain current(Body Diode)	$I_{SD}$	$T_C=25^{\circ}\text{C}$			3	A
Pulsed Source-drain current(Body Diode)	$I_{SDM}$				9	A
Forward On Voltage	$V_{SD}$	$T_J=25^{\circ}\text{C}, I_{SD}=3A, V_{GS}=0V$		0.8	1.1	V
Reverse Recovery Time	$t_{rr}$	$T_J=25^{\circ}\text{C}, I_F=3A,$ $di/dt=100A/\mu\text{s}$		390		nS
Reverse Recovery Charge	$Q_{rr}$			2.2		$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rrm}$			11		A

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

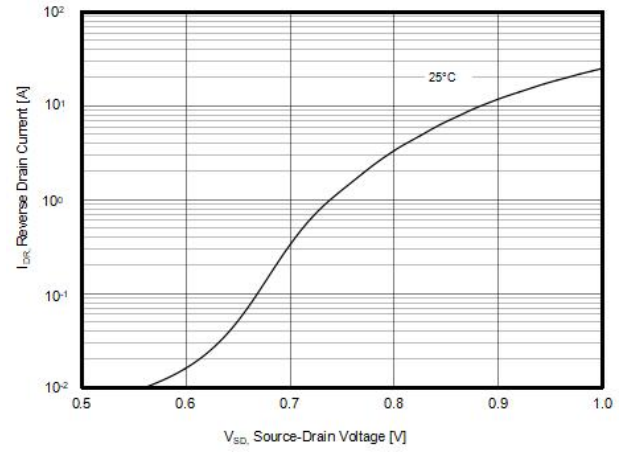
2.  $T_J=25^{\circ}\text{C}, V_{DD}=50V, V_G=10V, R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

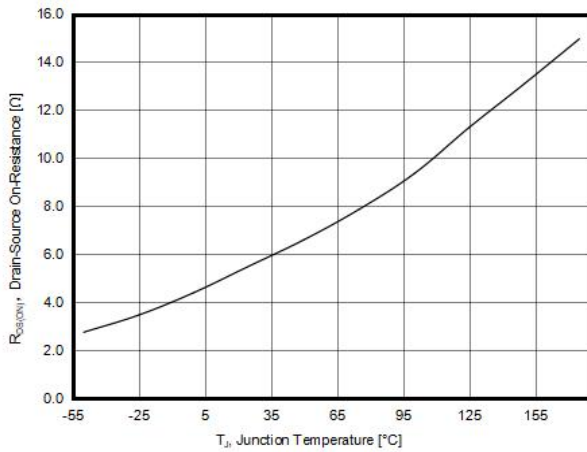
**Figure1. Safe operating area**



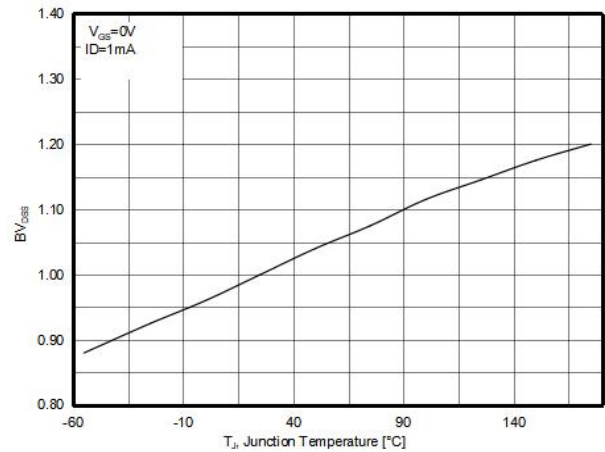
**Figure2. Source-Drain Diode Forward Voltage**



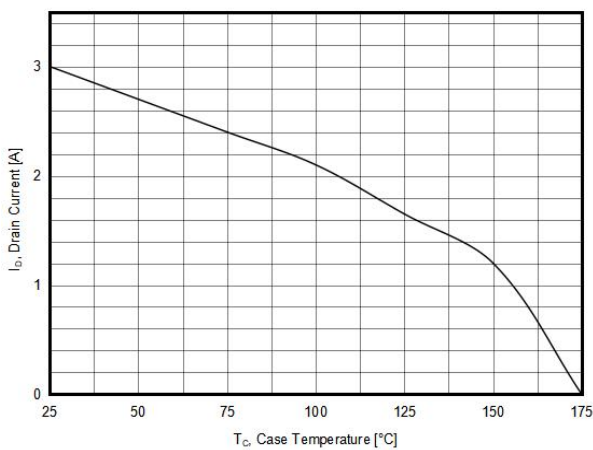
**Figure3. R<sub>DS(ON)</sub> vs Junction Temperature**



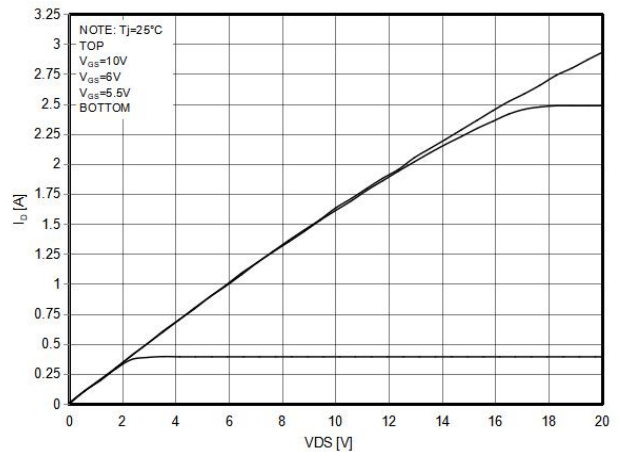
**Figure4. BV<sub>DSS</sub> vs Junction Temperature**



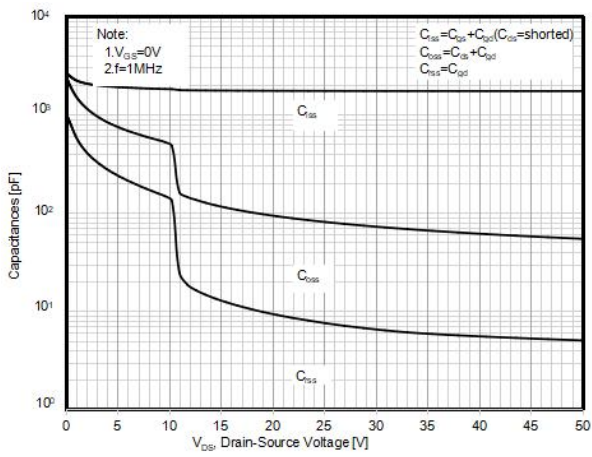
**Figure5. Maximum I<sub>D</sub> vs Junction Temperature**



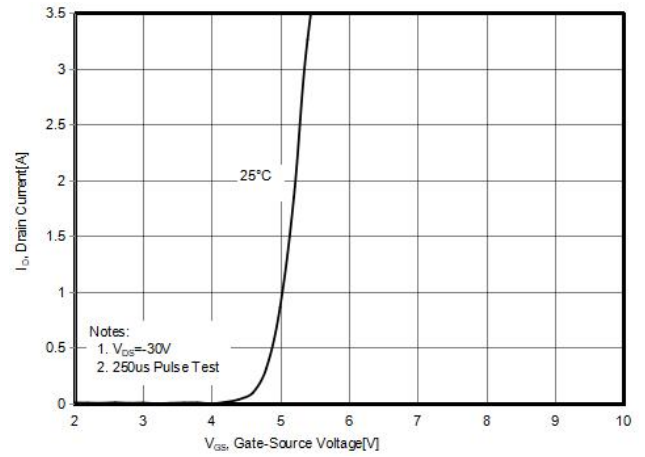
**Figure6. Output characteristics**



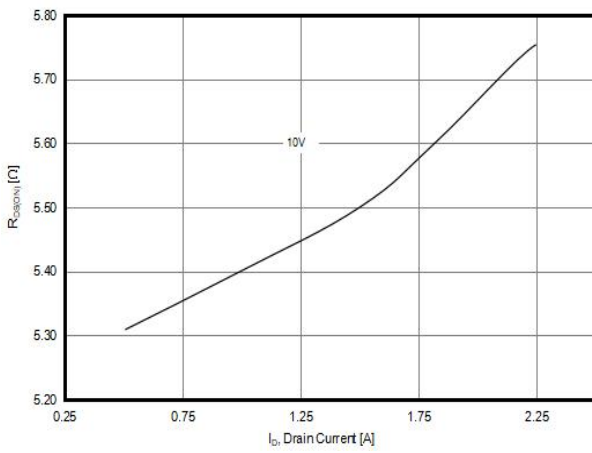
**Figure7. Capacitance**



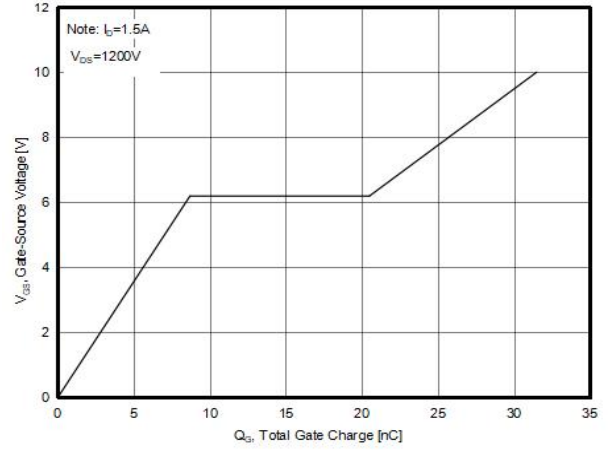
**Figure8. Transfer characteristics**



**Figure9. Static drain-source on resistance**

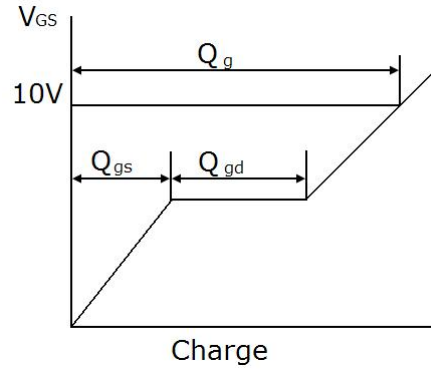
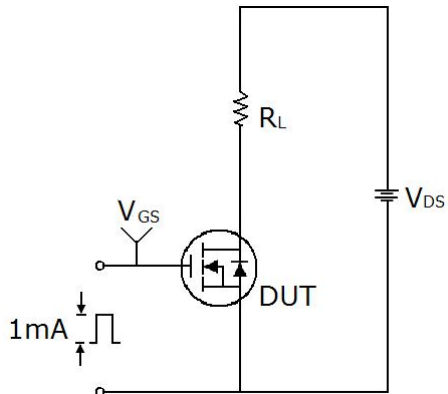


**Figure9. Gate charge waveforms**

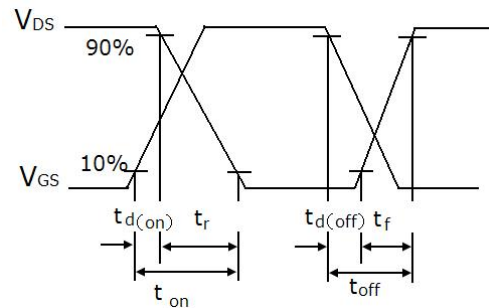
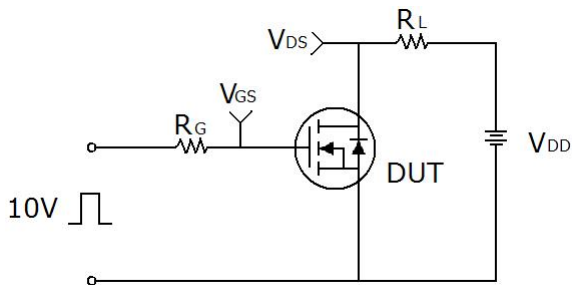


## Test circuit

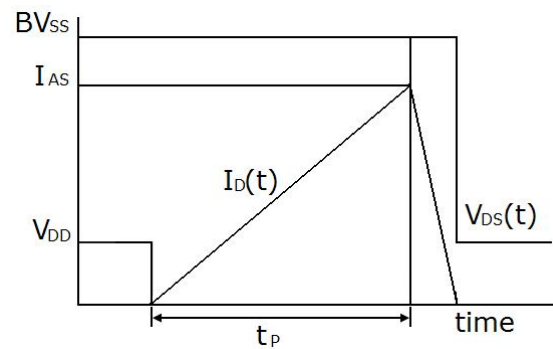
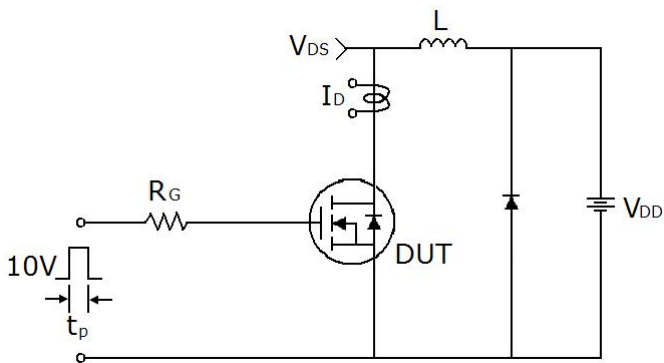
### 1) Gate charge test circuit & Waveform



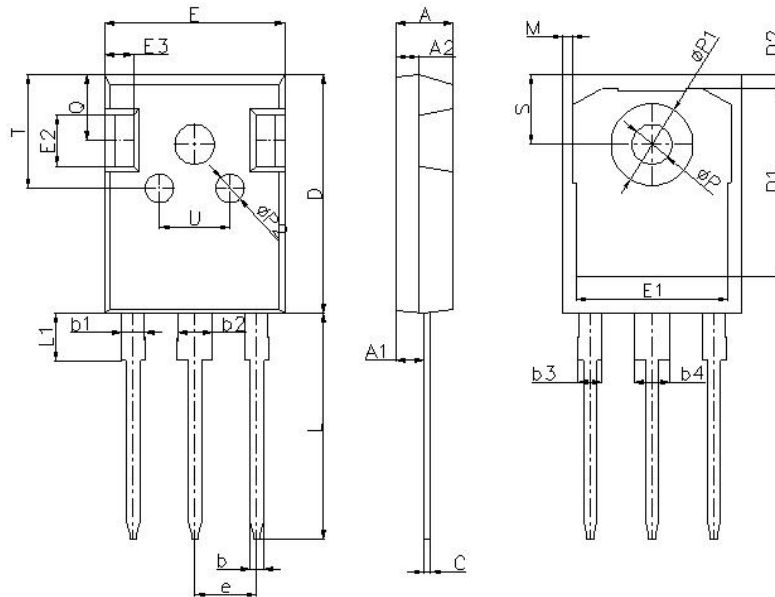
### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms

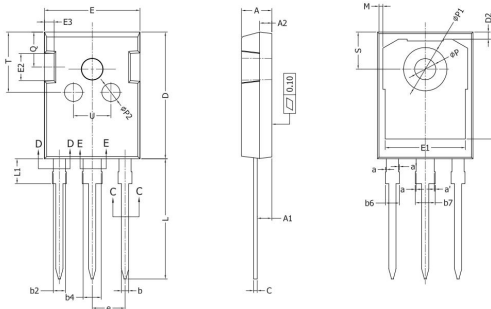


## TO-247-E Package Information



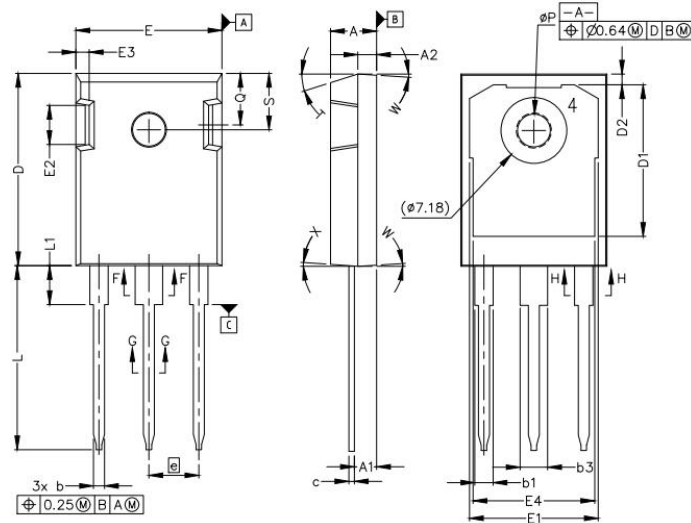
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.06	0.077	0.081
b2	2.96	3.06	0.117	0.120
b3	-	2.25	-	0.089
b4	-	3.25	-	0.128
C	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E2	4.40	4.60	0.173	0.181
E3	2.40	2.60	0.094	0.102
e	5.436BSC		0.214BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
M	0.35	0.95	0.014	0.037
Q	5.60	6.00	0.220	0.236
S	6.05	6.25	0.238	0.246
T	9.80	10.20	0.386	0.402
U	6.00	6.40	0.236	0.252

## TO-247-P Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	2.31	2.41	0.091	0.095
A2	1.90	2.00	0.075	0.079
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	1.96	2.06	0.077	0.081
b3	1.95	2.02	0.077	0.080
b4	2.96	3.06	0.117	0.120
b5	2.96	3.02	0.117	0.119
b6		2.25	0.000	0.089
b7		3.25	0.000	0.128
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	20.9	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E2	4.40	4.60	0.173	0.181
E3	2.40	2.60	0.094	0.102
e	5.436 BSC		0.214 BSC	
L	19.80	20.10	0.780	0.791
L1		4.30	0.000	0.169
M	0.35	0.95	0.014	0.037
P	3.40	3.60	0.134	0.142
P1	7.00	7.40	0.276	0.291
P2	2.40	2.60	0.094	0.102
Q	5.60	6.00	0.220	0.236
S	6.05	6.25	0.238	0.246
T	9.80	10.20	0.386	0.402
U	6.00	6.40	0.236	0.252

## TO-247-B Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.91	2.16	0.075	0.085
b'	1.07	1.28	0.042	0.050
b	1.07	1.33	0.042	0.052
b1	1.91	2.41	0.075	0.095
b2	1.91	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
c'	0.55	0.65	0.022	0.026
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.25	0.037	0.049
E	15.75	16.13	0.620	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	1.90	0.039	0.075
E4	12.38	13.43	0.487	0.529
e	5.44 BSC		0.214 BSC	
L	19.81	20.32	0.780	0.800
L1	4.10	4.40	0.161	0.173
Q	5.60	6.00	0.220	0.236
S	6.05	6.25	0.238	0.246

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