

N-Channel Enhancement Mode Power MOSFET

LUD5N50

BV_{DSS} : 500V
 $R_{DS(ON)}$ max. : 1.6 Ω
 I_D : 4.5A

Description

The LUD5N50 is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-252 package is universally preferred for all commercial-industrial applications

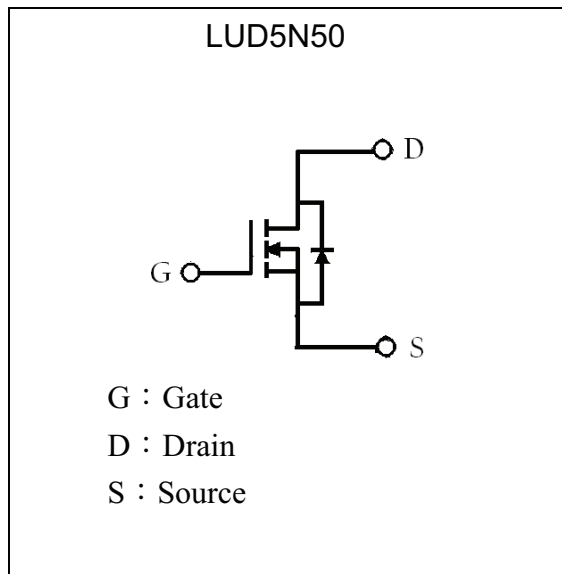
Features

- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

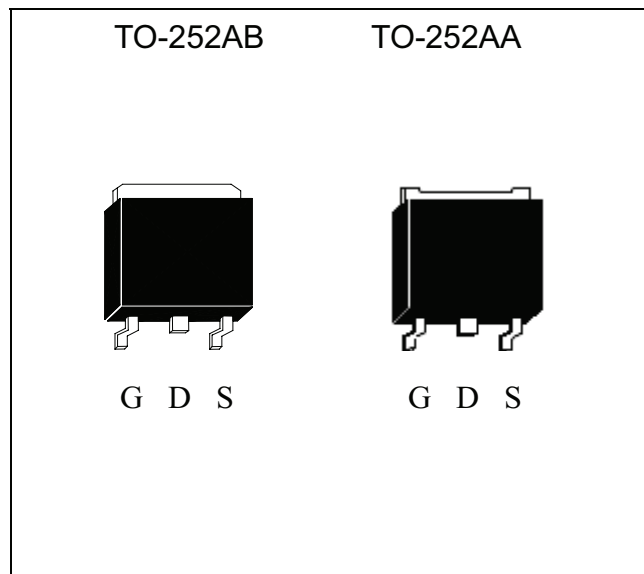
Applications

- Open Framed Power Supply
- Adapter
- STB
- BLDC Motor Control Application

Symbol



Outline



Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Limits	Unit
Drain-Source Voltage	V _{DS}	500	V
Gate-Source Voltage	V _{GS}	±30	V
Continuous Drain Current	I _D	4.5	A
Continuous Drain Current @T _C =100°C	I _D	2.7	A
Pulsed Drain Current @ V _{GS} =10V (Note 1)	I _{DM}	18	A
Single Pulse Avalanche Energy (Note 2)	E _{AS}	90	mJ
Avalanche Current (Note 1)	I _{AR}	4.5	A
Repetitive Avalanche Energy (Note 1)	E _{AR}	4.8	mJ
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5	V/ns
Maximum Temperature for Soldering @ Lead at 0.125 in(0.318mm) from case for 10 seconds	T _L	300	°C
Total Power Dissipation (T _A =25°C)	P _D	1.5	W
Total Power Dissipation (T _C =25°C)		48	W
Linear Derating Factor		0.38	W/°C
Operating Junction and Storage Temperature	T _j , T _{stg}	-55~+150	°C

Note : 1.Repetitive rating; pulse width limited by maximum junction temperature.

2. I_{AS}=4.5A, V_{DD}=50V, L=8mH, R_G=25Ω, starting T_J=+25°C.

3. I_{SD}≤4.5A, dI/dt≤100A/μs, V_{DD}≤BV_{DSS}, starting T_J=+25°C.

Thermal Data

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	R _{th,j-c}	2.6	°C/W
Thermal Resistance, Junction-to-ambient, max	R _{th,j-a}	83	°C/W

Characteristics (Tc=25°C, unless otherwise specified)

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Static					
BV _{DSS}	500	-	-	V	V _{GS} =0, I _D =250μA, T _j =25°C
ΔBV _{DSS} /ΔT _j	-	0.4	-	V/°C	Reference to 25°C, I _D =250μA
V _{GS(th)}	2.0	-	4.0	V	V _{DS} = V _{GS} , I _D =250μA
*G _{FS}	-	2	-	S	V _{DS} =15V, I _D =2.25A
I _{GSS}	-	-	±100	nA	V _{GS} =±30
I _{DSS}	-	-	1	μA	V _{DS} =500V, V _{GS} =0
	-	-	10	μA	V _{DS} =400V, V _{GS} =0, T _C =125°C
*R _{DS(ON)}	-	-	1.6	Ω	V _{GS} =10V, I _D =2.25A
Dynamic					
*Q _g	-	20	-	nC	I _D =4.5A, V _{DD} =400V, V _{GS} =10V
*Q _{gs}	-	3.8	-		
*Q _{gd}	-	10.6	-		
*t _{d(ON)}	-	18	-	ns	V _{DD} =250V, I _D =4.5A, V _{GS} =10V, R _G =25Ω
*t _r	-	21	-		
*t _{d(OFF)}	-	33	-		
*t _f	-	20	-		
C _{iss}	-	738	-	pF	V _{GS} =0V, V _{DS} =25V, f=1MHz
C _{oss}	-	74	-		
C _{rss}	-	8	-		
Source-Drain Diode					
*V _{SD}	-	-	1.5	V	I _S =4.5A, V _{GS} =0V
*I _S	-	-	4.5	A	
*I _{SM}	-	-	18		
*t _{rr}	-	280	-	ns	V _{GS} =0, I _F =4.5A, dI/dt=100A/μs
*Q _{rr}	-	2	-	μC	

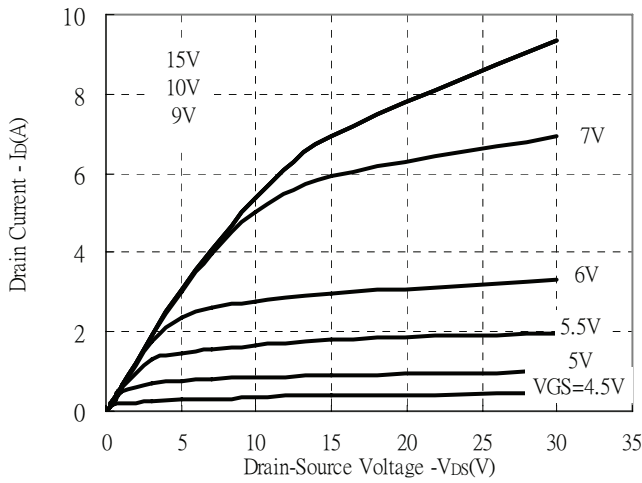
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

Ordering Information

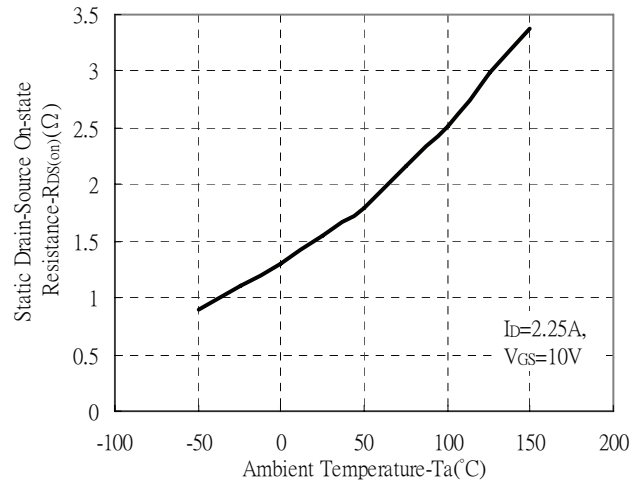
Device	Package	Shipping
LUD5N50	TO-252 (Pb-free lead plating package)	2500 pcs / tape & reel

Typical Characteristics

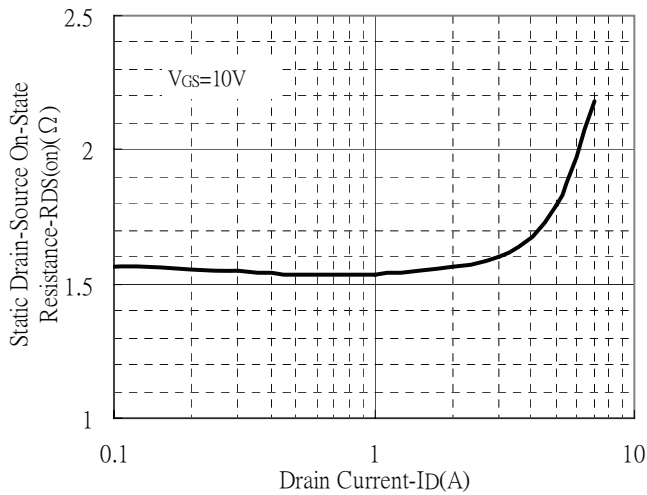
Typical Output Characteristics



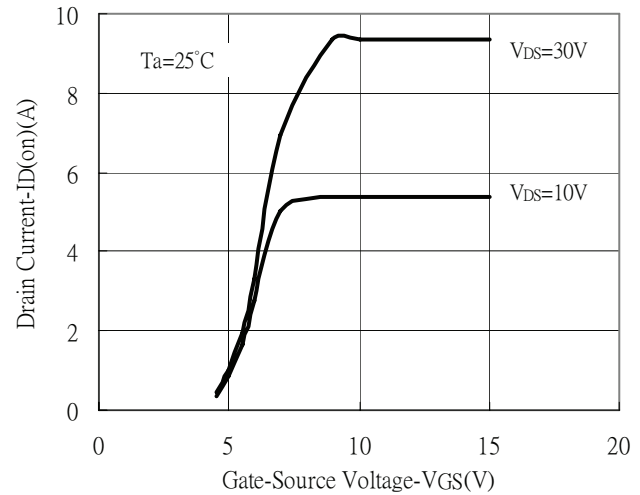
Static Drain-Source On-resistance vs Ambient Temperature



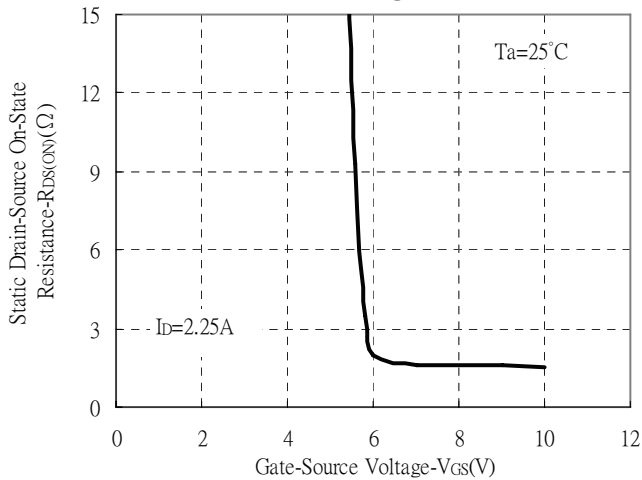
Static Drain-Source On-State resistance vs Drain Current



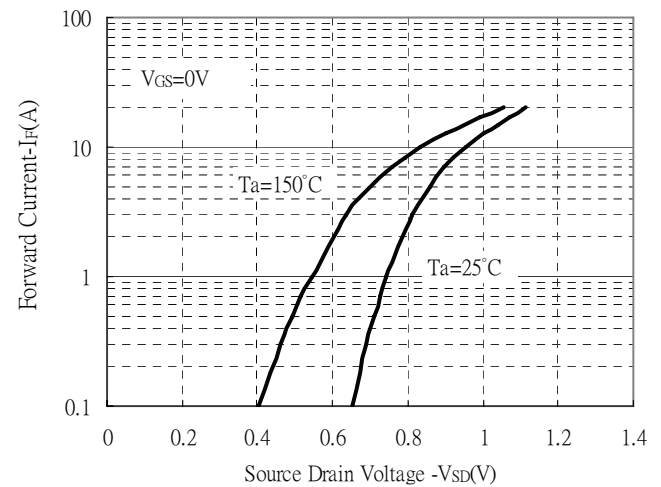
Drain Current vs Gate-Source Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage

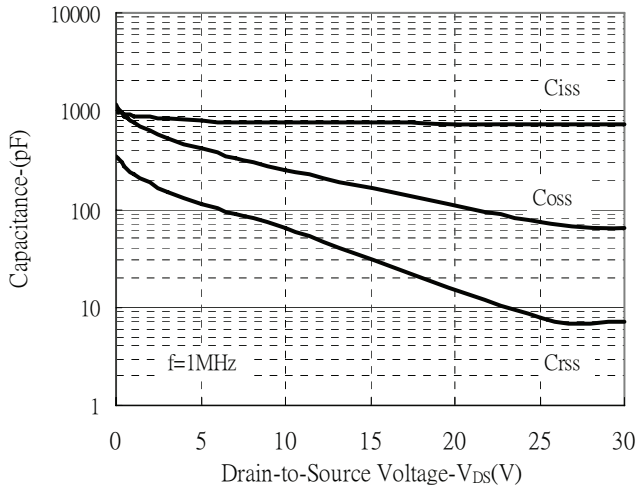


Forward Drain Current vs Source-Drain Voltage

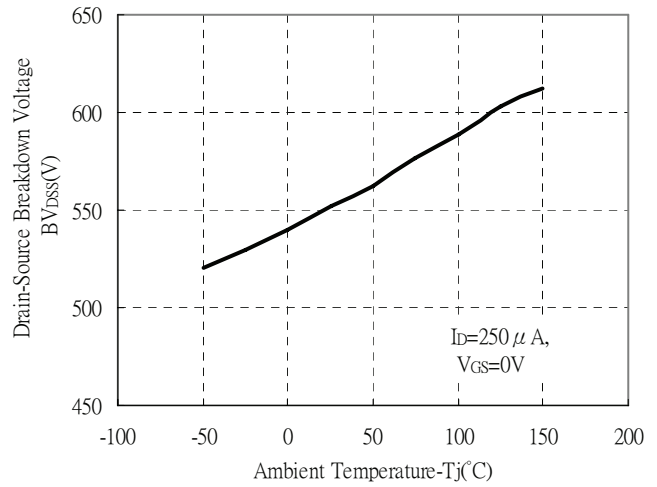


Typical Characteristics(Cont.)

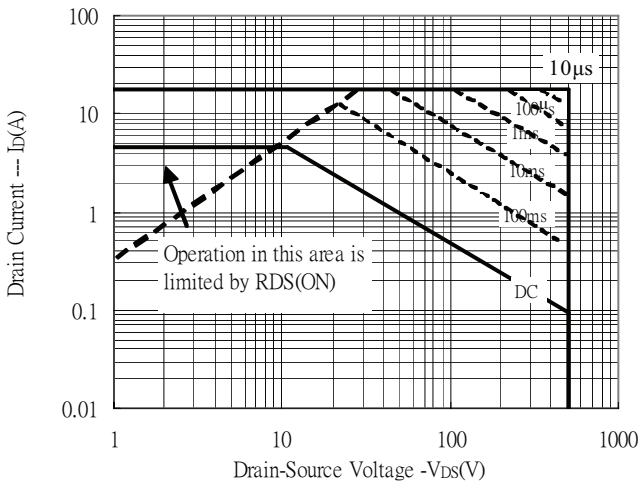
Capacitance vs Reverse Voltage



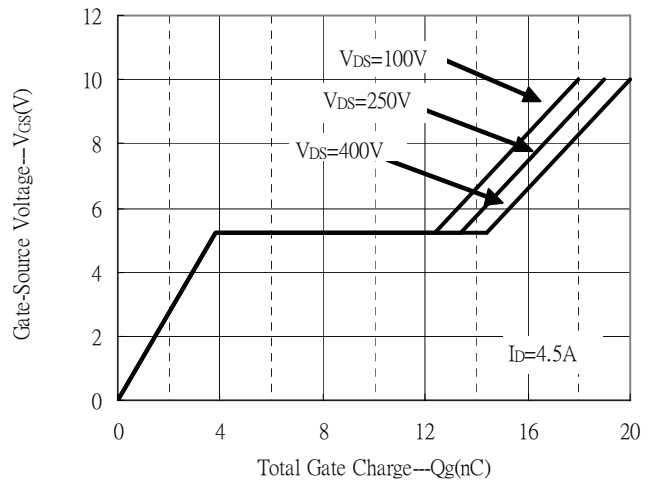
Brekdown Voltage vs Ambient Temperature



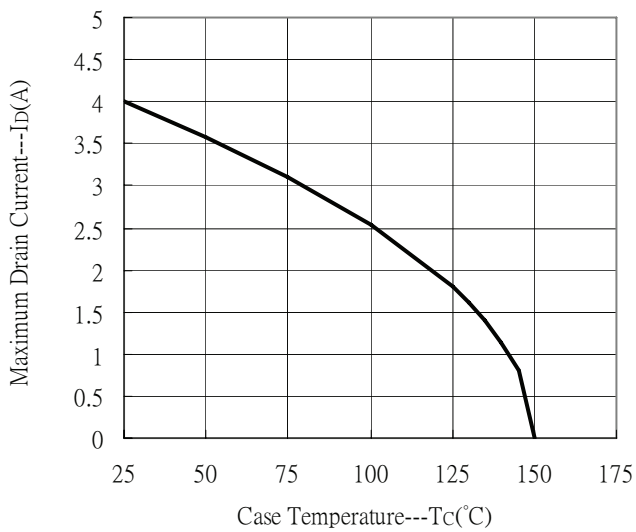
Maximum Safe Operating Area



Gate Charge Characteristics

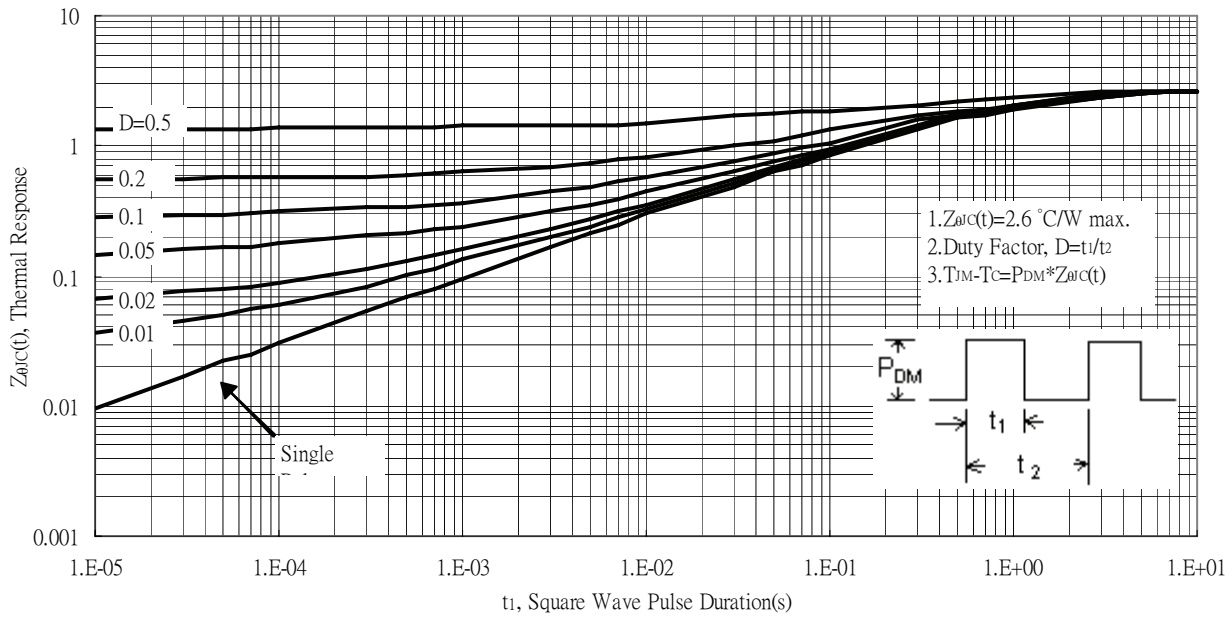


Maximum Drain Current vs Case Temperature

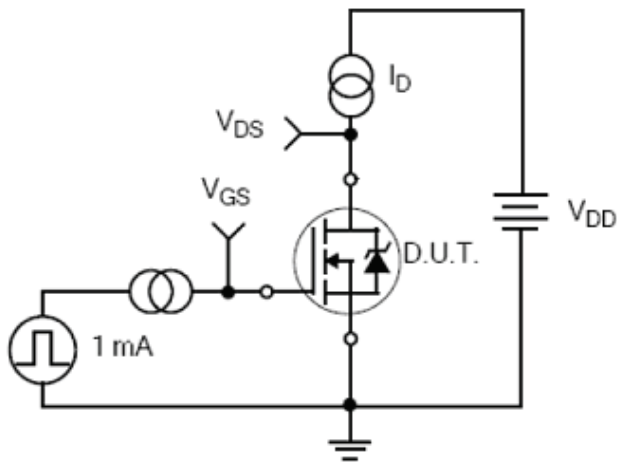


Typical Characteristics(Cont.)

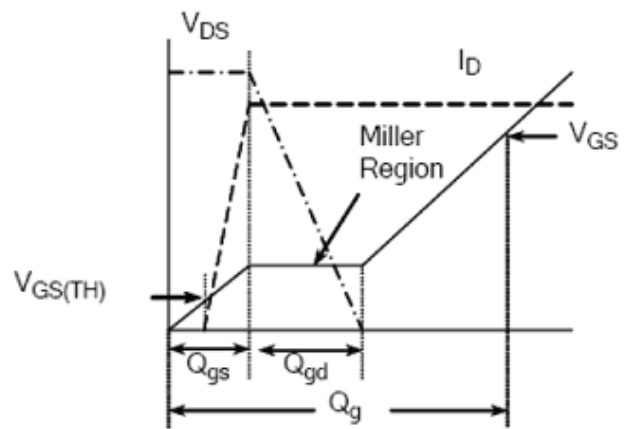
Transient Thermal Response Curves



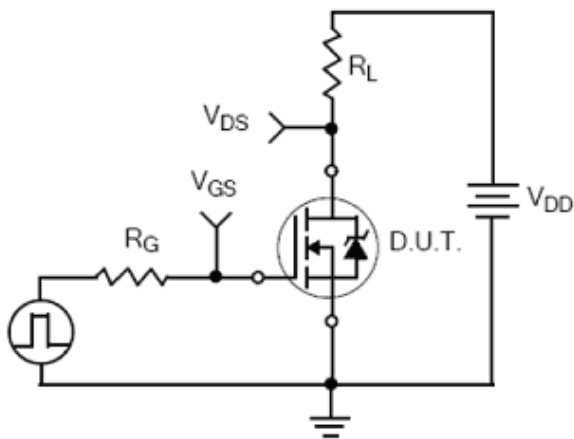
Test Circuit and Waveforms



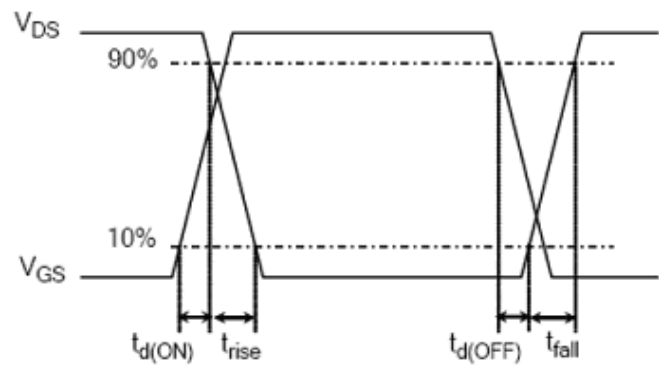
Gate Charge Test Circuit



Gate Charge Waveform

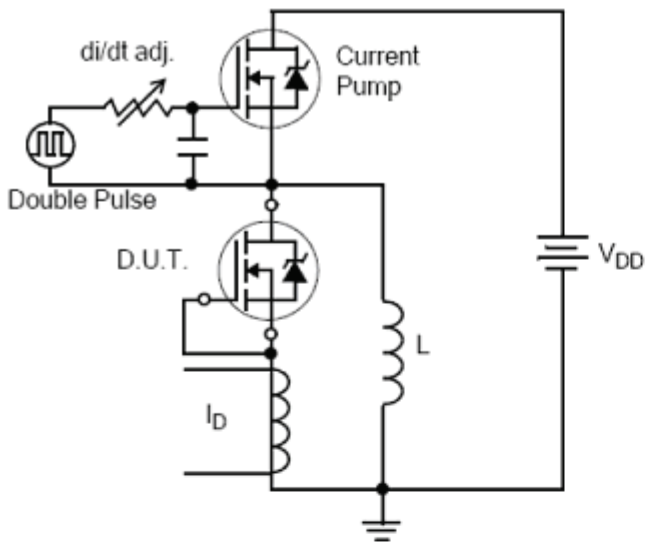


Resistive Switching Test Circuit

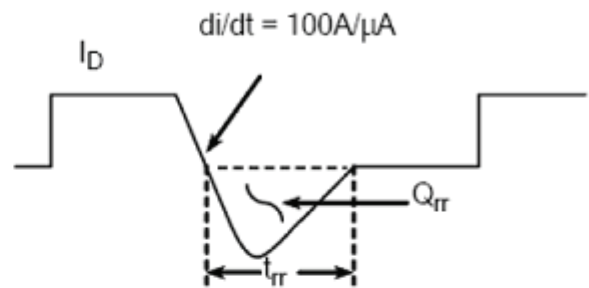


Resistive Switching Waveforms

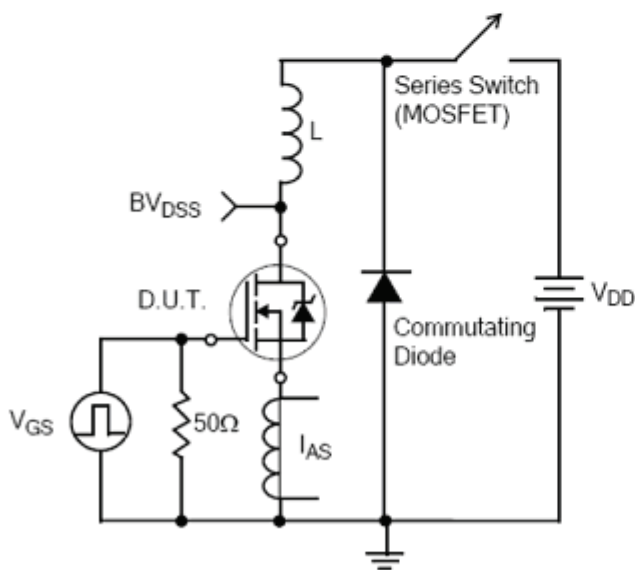
Test Circuit and Waveforms(Cont.)



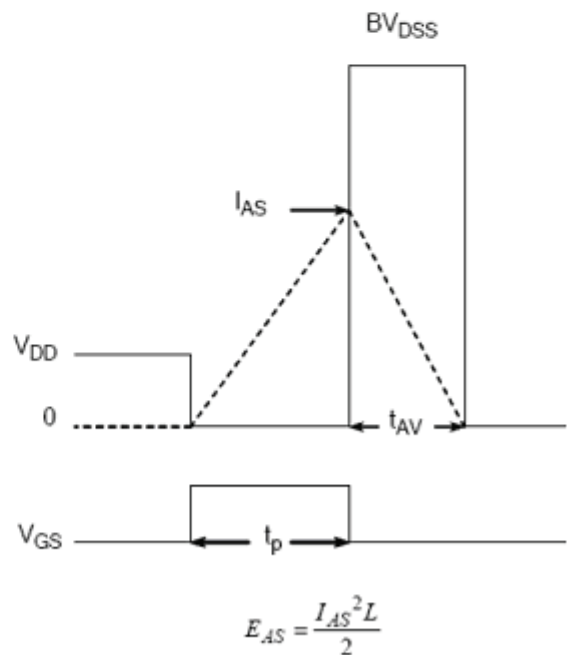
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform

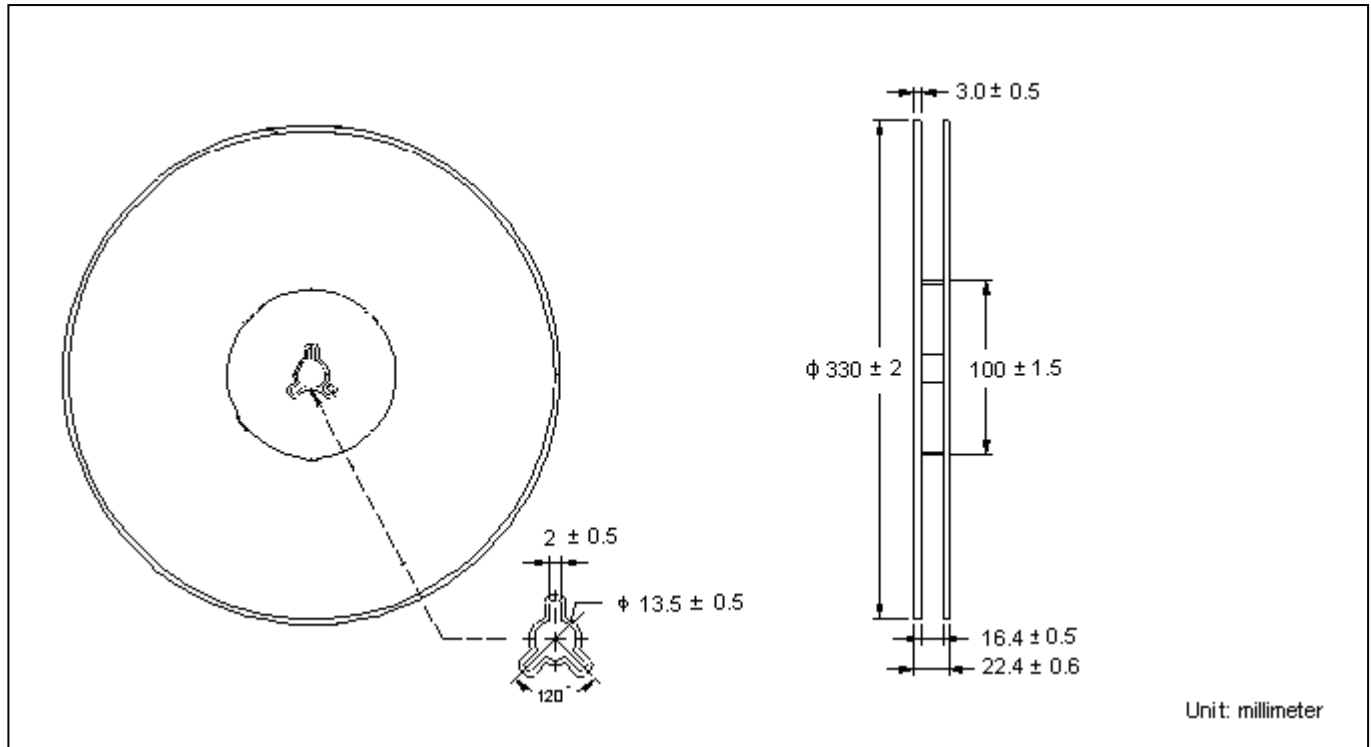


Unclamped Inductive Switching Test Circuit

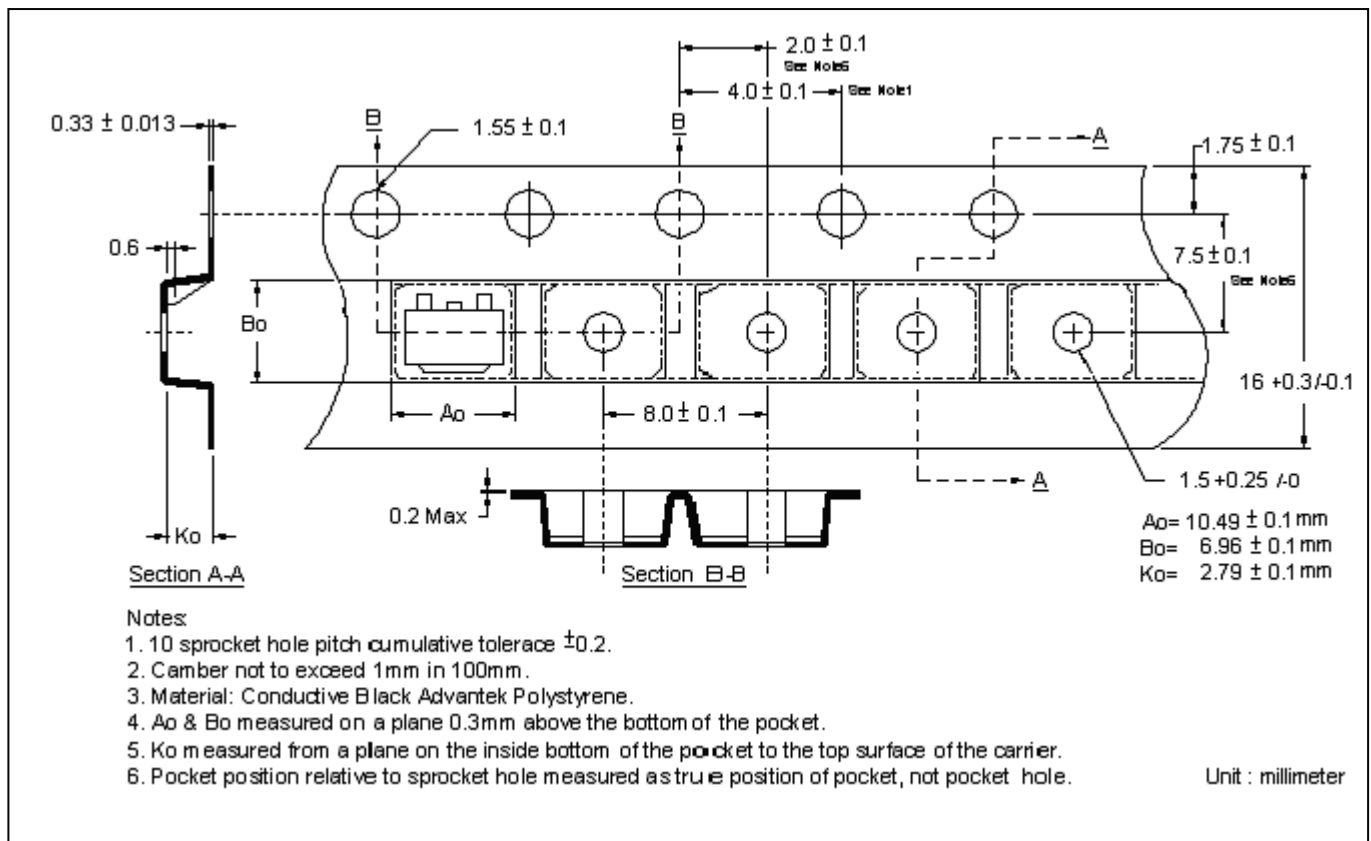


Unclamped Inductive Switching Waveforms

Reel Dimension



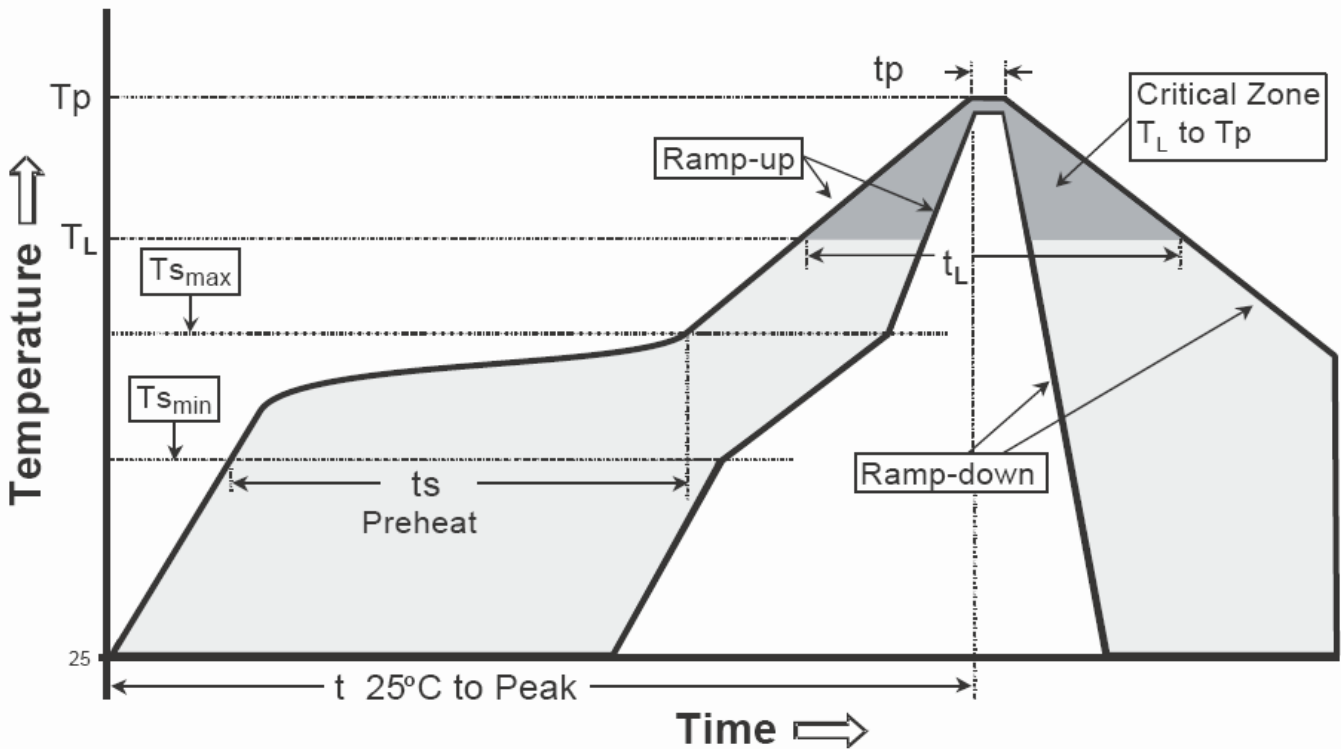
Carrier Tape Dimension



Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

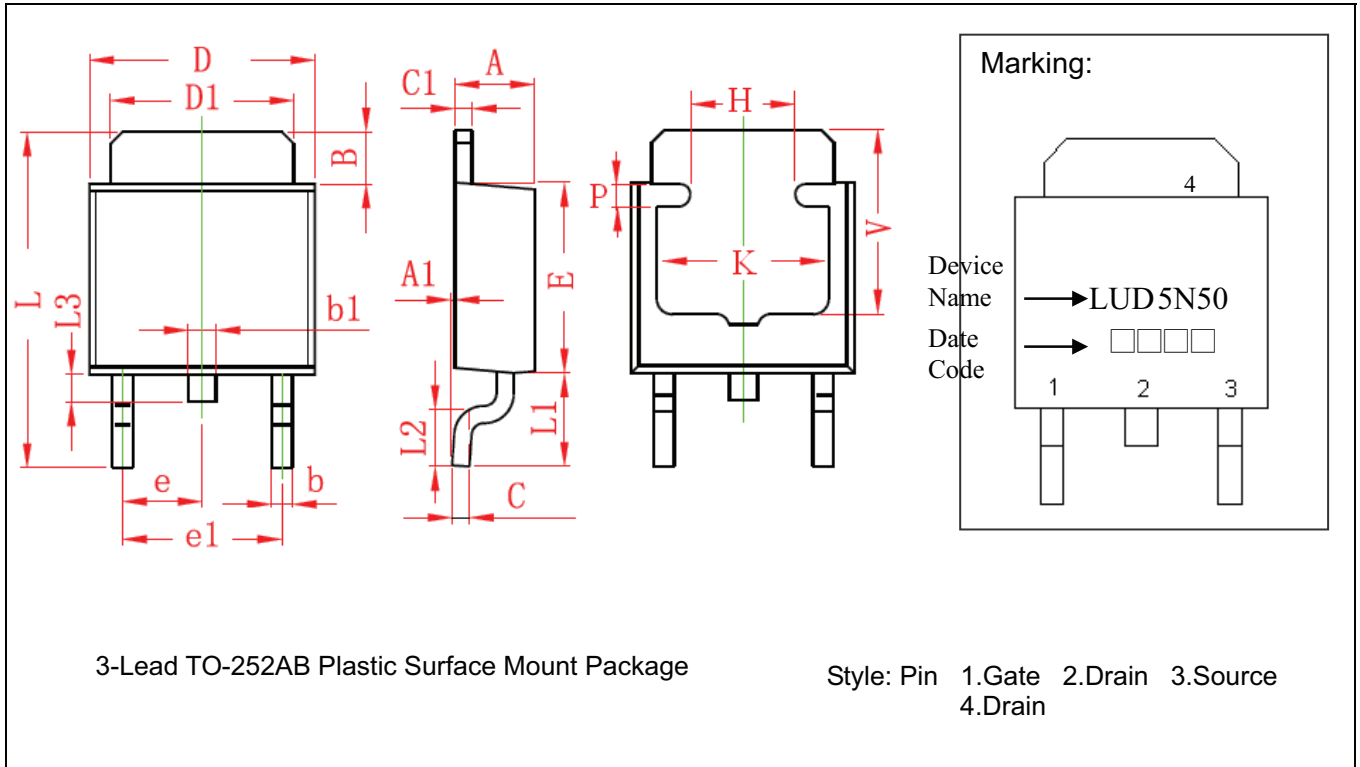
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (Tl)	183°C	217°C
- Time (tl)	60-150 seconds	60-150 seconds
Peak Temperature(TP)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

TO-252AB Dimension



*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.087	0.094	2.200	2.400	e	*0.091		*2.300	
A1	0.000	0.005	0.000	0.127	e1	0.177	0.185	4.500	4.700
B	0.053	0.065	1.350	1.650	H	0.118	REF	3.000	REF
b	0.020	0.028	0.500	0.700	K	0.197	REF	5.000	REF
b1	0.028	0.035	0.700	0.900	L	0.374	0.390	9.500	9.900
C	0.017	0.023	0.430	0.580	L1	0.100	0.114	2.550	2.900
C1	0.017	0.023	0.430	0.580	L2	0.055	0.070	1.400	1.780
D	0.250	0.262	6.350	6.650	L3	0.024	0.035	0.600	0.900
D1	0.205	0.213	5.200	5.400	P	0.028	REF	0.700	REF
E	0.213	0.224	5.400	5.700	V	0.209	REF	5.300	REF

Notes: 1.Controlling dimension: millimeters.

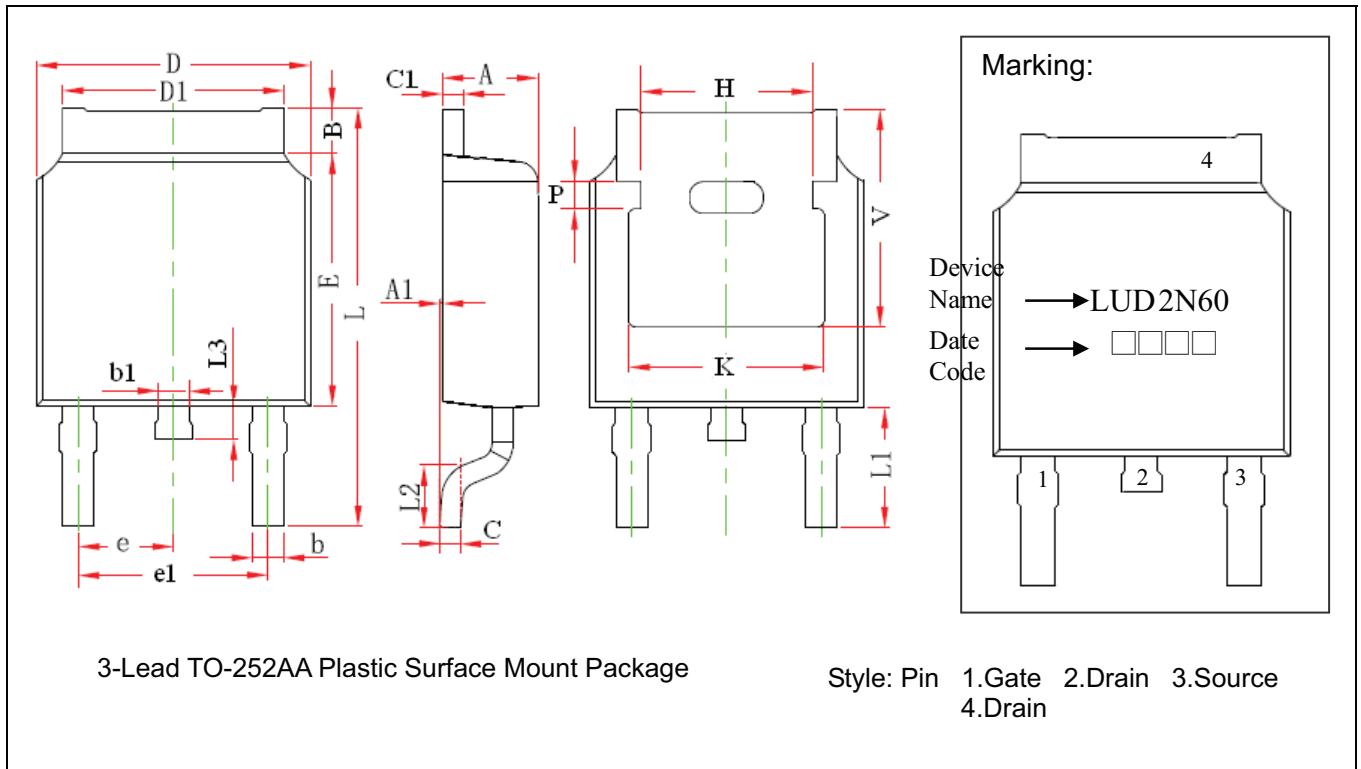
2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.

3.If there is any question with packing specification or packing method, please contact your local LUL sales office.

Material:

- Lead : Pure tin plated
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

TO-252AA Dimension



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.087	0.094	2.200	2.400	e	0.086	0.094	2.186	2.386
A1	0.000	0.005	0.000	0.127	e1	0.172	0.188	4.372	4.772
B	0.039	0.048	0.990	1.210	H	0.163	REF	4.140	REF
b	0.026	0.034	0.660	0.860	K	0.190	REF	4.830	REF
b1	0.026	0.034	0.660	0.860	L	0.386	0.409	9.800	10.400
C	0.018	0.023	0.460	0.580	L1	0.114	REF	2.900	REF
C1	0.018	0.023	0.460	0.580	L2	0.055	0.067	1.400	1.700
D	0.256	0.264	6.500	6.700	L3	0.024	0.039	0.600	1.000
D1	0.201	0.215	5.100	5.460	P	0.026	REF	0.650	REF
E	0.236	0.244	6.000	6.200	V	0.211	REF	5.350	REF

Notes: 1. Controlling dimension: millimeters.

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Material:

- Lead : Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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