



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit	
<b>Common Ratings</b> ( $T_C=25^\circ\text{C}$ Unless Otherwise Noted)				
$V_{DSS}$	Drain-Source Voltage	30	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 20$		
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$	
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$	42	A
<b>Mounted on Large Heat Sink</b>				
$I_{DM}$	Pulsed Drain Current *	$T_C=25^\circ\text{C}$	140**	A
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$	42	A
		$T_C=100^\circ\text{C}$	30	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$	30	W
		$T_C=100^\circ\text{C}$	12	
$R_{\theta JC}$	Thermal Resistance-Junction to Case		4.2	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient		110	$^\circ\text{C}/\text{W}$
$E_{AS}$	Drain-Source Avalanche Energy	$L=0.5\text{mH}$	70***	mJ

Note : \* Repetitive rating ; pulse width limited by junction temperature

\*\* Drain current is limited by junction temperature

\*\*\*  $V_D=24\text{V}$

## Electrical Characteristics ( $T_C = 25^\circ\text{C}$ Unless Otherwise Noted)

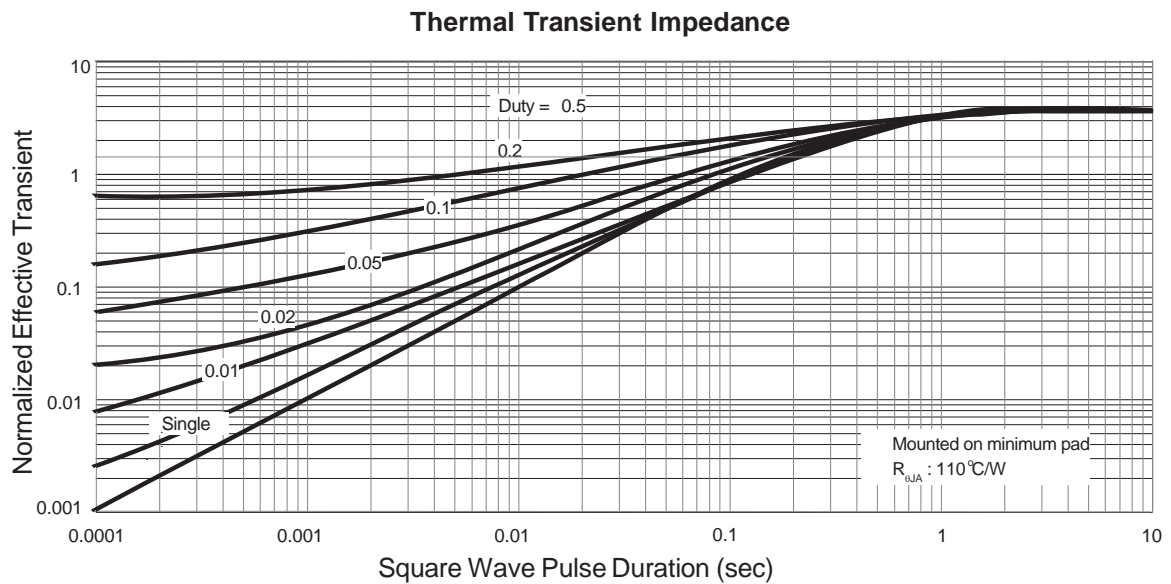
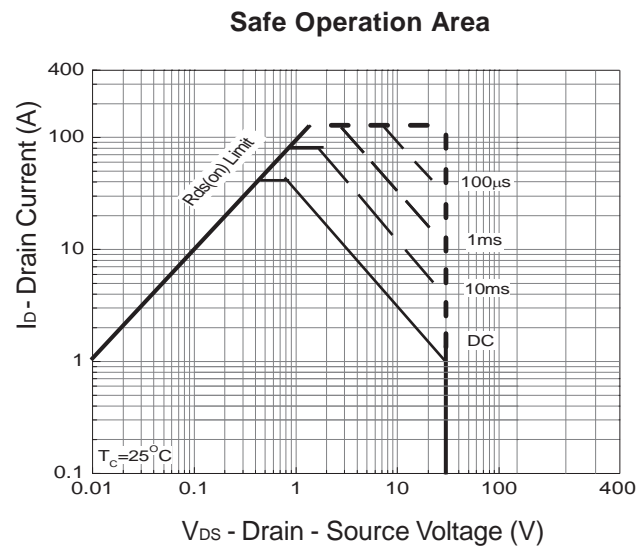
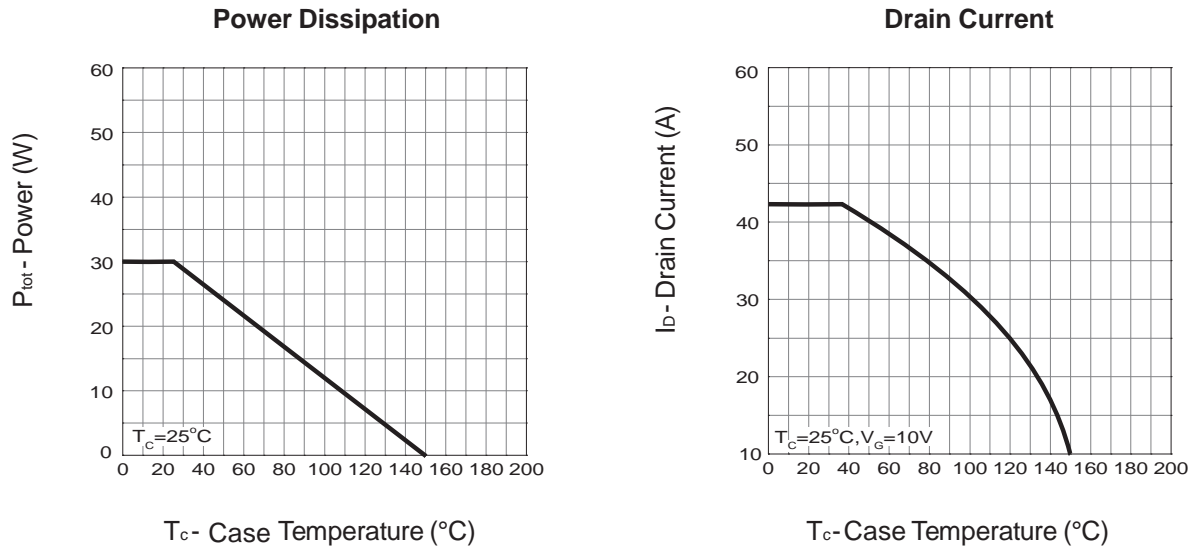
Symbol	Parameter	Test Conditions	HY1403			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	30	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}, V_{GS}=0\text{V}$ $T_J=125^\circ\text{C}$	-	-	1	$\mu\text{A}$
			-	-	50	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	1.0	1.6	3.0	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 20\text{V}, V_{DS}=0\text{V}$	-	-	$\pm 100$	nA
$R_{DS(ON)}^*$	Drain-Source On-state Resistance	$V_{GS}=10\text{V}, I_{DS}=21\text{A}$	-	10	11	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_{DS}=21\text{A}$		14	17	$\text{m}\Omega$
<b>Diode Characteristics</b>						
$V_{SD}^*$	Diode Forward Voltage	$I_{SD}=21\text{A}, V_{GS}=0\text{V}$	-	0.8	1.1	V
$t_{rr}$	Reverse Recovery Time	$I_{DS}=21\text{A}, di_{SD}/dt=100\text{A}/\mu\text{s}$	-	21	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	13	-	nC

**Electrical Characteristics (Cont.)** ( $T_C = 25^\circ\text{C}$  Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HY1403			Unit
			Min.	Typ.	Max.	
<b>Dynamic Characteristics</b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	-	2.9	-	$\Omega$
$C_{ISS}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=15V,$ Frequency=1.0MHz	-	1012	-	pF
$C_{OSS}$	Output Capacitance		-	251	-	
$C_{RSS}$	Reverse Transfer Capacitance		-	119	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=15V, R_G=3\Omega,$ $I_{DS}=21A, V_{GS}=10V,$	-	15	28	ns
$T_r$	Turn-on Rise Time		-	13	24	
$t_{d(OFF)}$	Turn-off Delay Time		-	20	35	
$T_f$	Turn-off Fall Time		-	10	19	
<b>Gate Charge Characteristics</b>						
$Q_g$	Total Gate Charge	$V_{DS}=24V, V_{GS}=10V,$ $I_{DS}=21A$	-	29	-	nC
$Q_{gs}$	Gate-Source Charge		-	4.6	-	
$Q_{gd}$	Gate-Drain Charge		-	4.3	-	

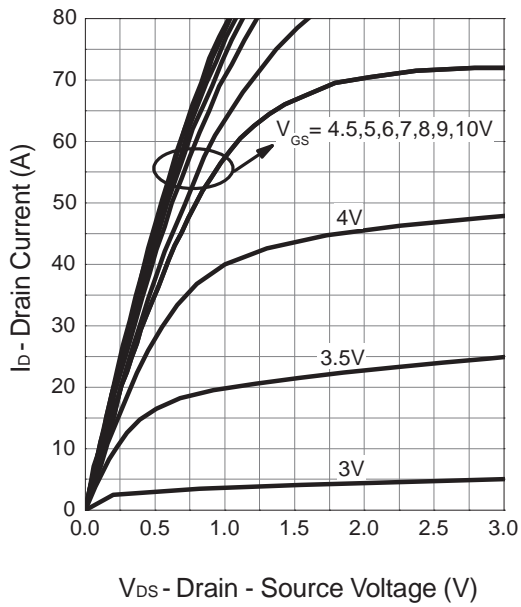
Note \* : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .

### Typical Operating Characteristics

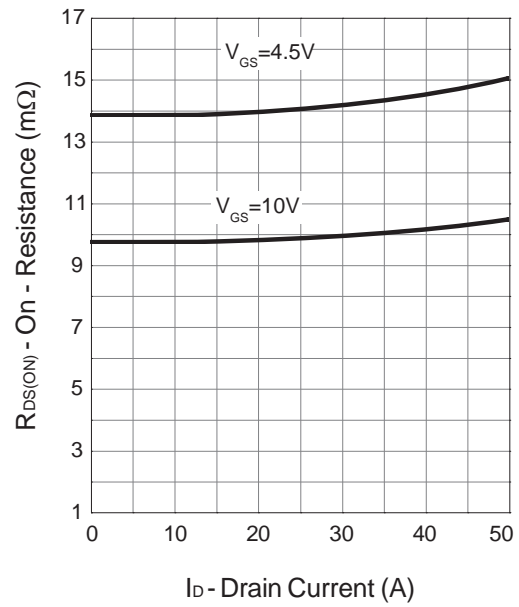


**Typical Operating Characteristics (Cont.)**

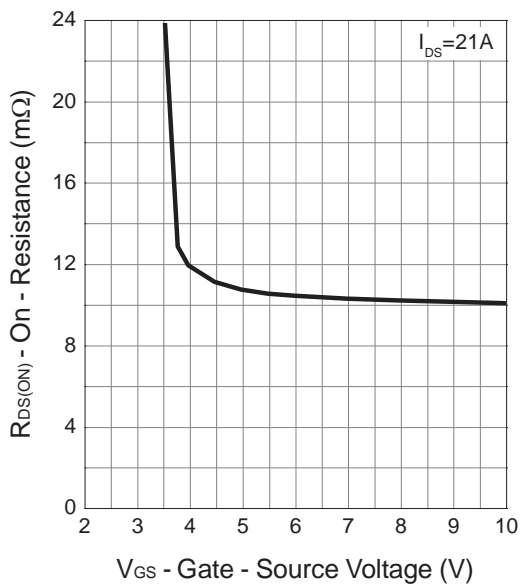
**Output Characteristics**



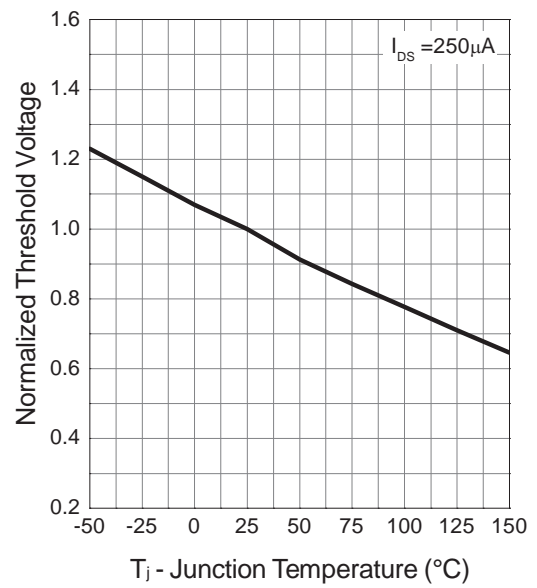
**Drain-Source On Resistance**



**Gate-Source On Resistance**

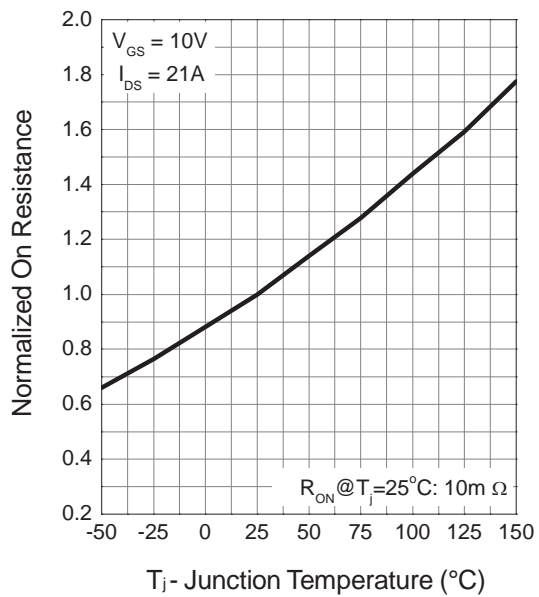


**Gate Threshold Voltage**

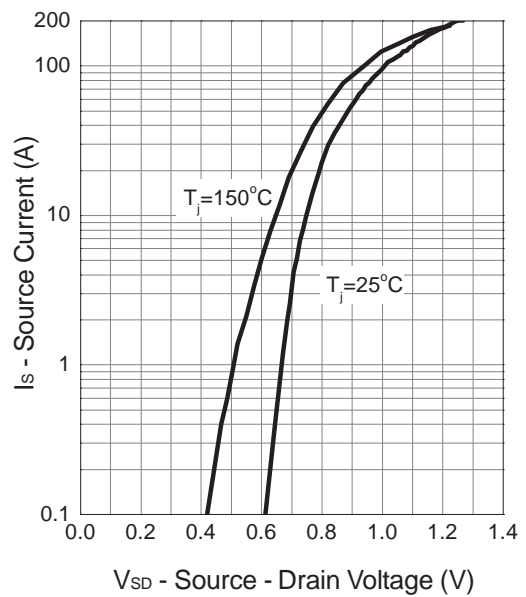


**Typical Operating Characteristics (Cont.)**

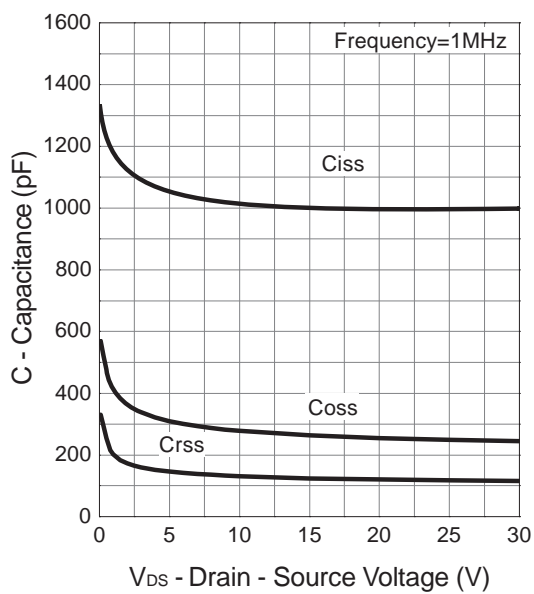
**Drain-Source On Resistance**



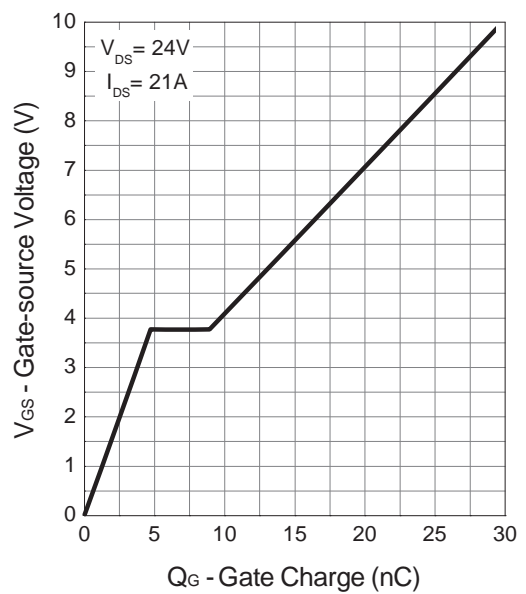
**Source-Drain Diode Forward**



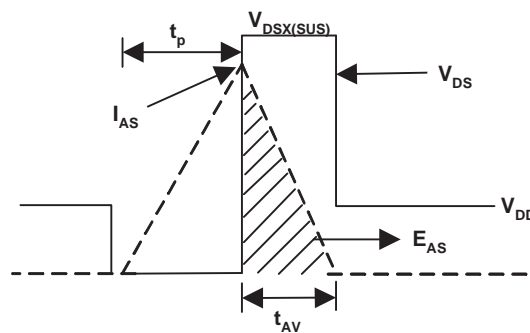
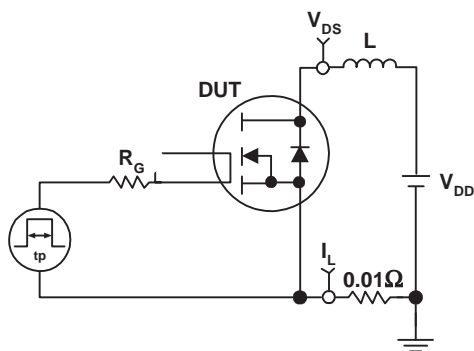
**Capacitance**



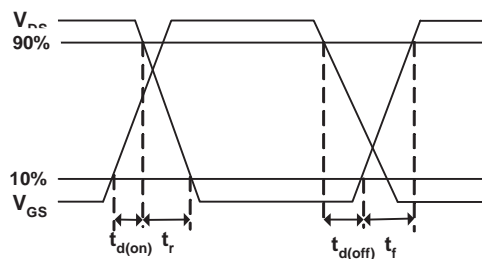
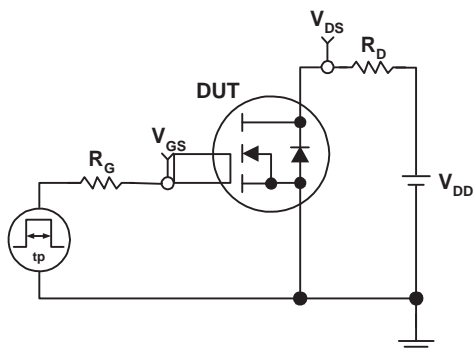
**Gate Charge**



### Avalanche Test Circuit

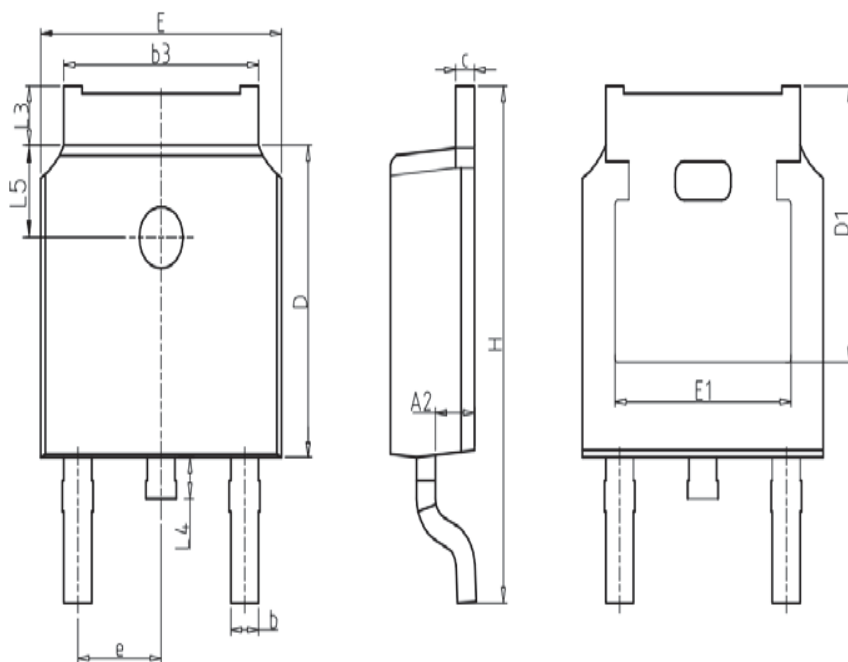


### Switching Time Test Circuit



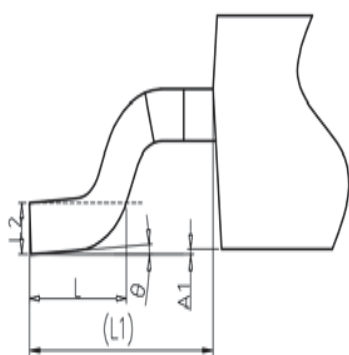
Package Information

TO-252-2L



COMMON DIMENSIONS

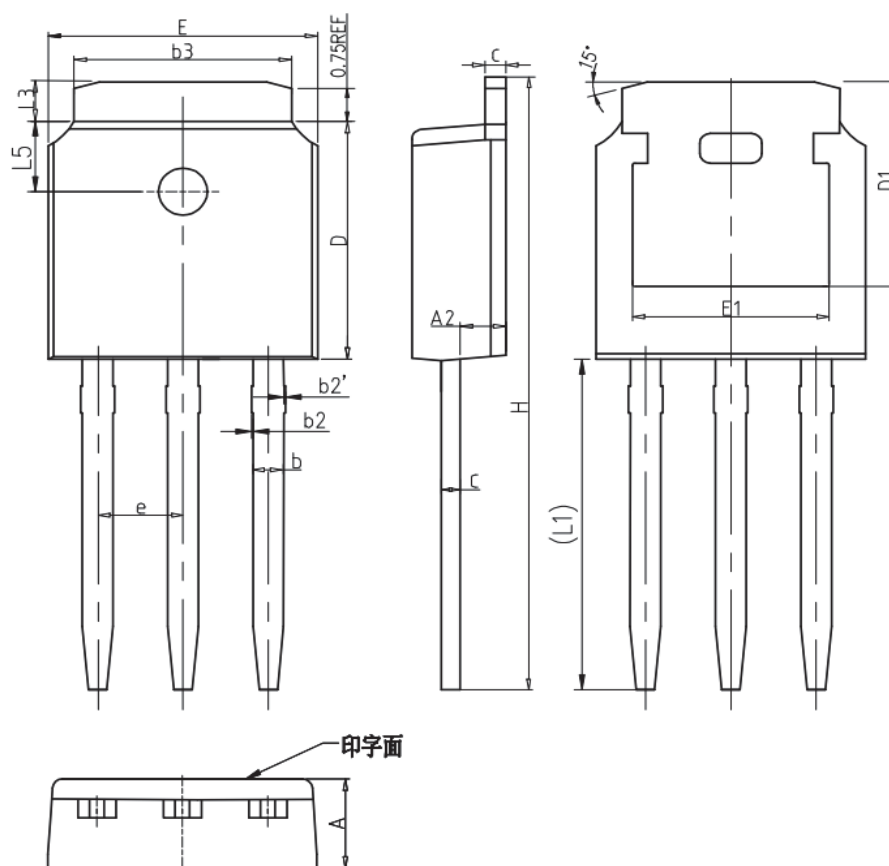
SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	-	1.28
L4	-	-	1.00
L5	1.65	1.80	1.95
$\theta$	0°	-	8°



SECTION C-C



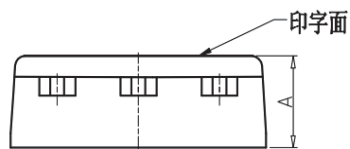
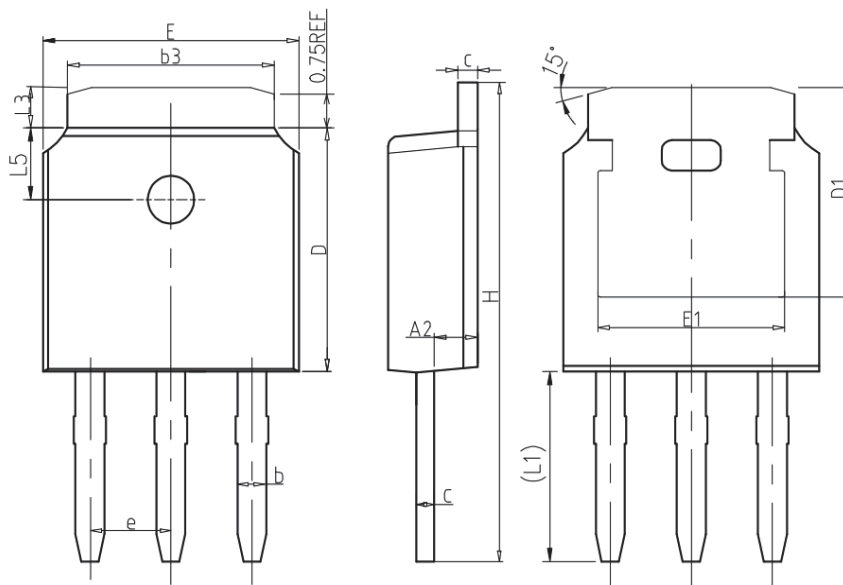
TO-251-3L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b2	0.00	0.04	0.10
b2'	0.00	0.04	0.10
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.286BSC		
H	16.22	16.52	16.82
L1	9.15	9.40	9.65
L3	0.88	1.02	1.28
L5	1.65	1.80	1.95

TO-251-3L



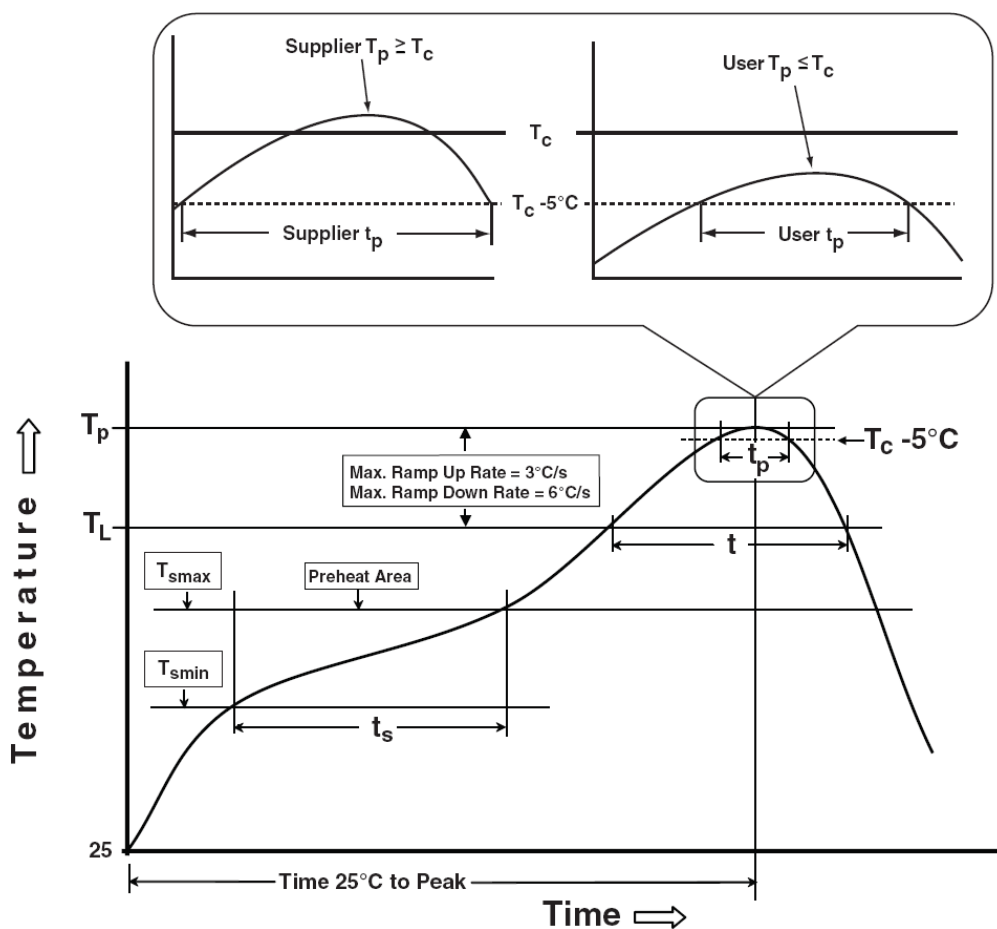
COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.286BSC		
H	10.00	11.22	11.44
L1	3.90	4.10	4.30
L3	0.88	1.02	1.28
L5	1.65	1.80	1.95

### Devices Per Unit

Package Type	Unit	Quantity
TO-252-3L	Tube	72
TO-251-3L	Tube	72

### Classification Profile



## Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
Temperature min ( $T_{smin}$ )	100 °C	150 °C
Temperature max ( $T_{smax}$ )	150 °C	200 °C
Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60-120 seconds	60-120 seconds
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C/second max.	3°C/second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time at liquidous ( $t_L$ )	60-150 seconds	60-150 seconds
Peak package body Temperature ( $T_p$ )*	See Classification Temp in table 1	See Classification Temp in table 2
Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )	20** seconds	30** seconds
Average ramp-down rate ( $T_p$ to $T_{smax}$ )	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HOLT	JESD-22, A108	168 Hrs /500 Hrs /1000 Hrs, Bias @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -55°C~150°C

### Customer Service

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