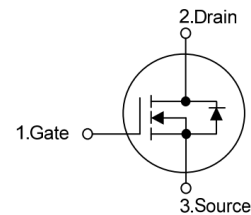


4A, 650V N-CHANNEL POWER MOSFET

Features

- $R_{DS(on)}=2.92\Omega$ (Max.) @ $V_{GS}=10V, I_D=2A$
- Low gate charge
- Low Ciss
- Fast switching



Applications

- LED Power Supplies
- Cell Phone Charger
- Standby Power

Key Performance and Package Parameters

Order codes	V_{DS}	I_D	$R_{DS(ON)}$, Typ	T_{vjmax}	Marking	Package
XD004M065BX1H3	650V	4A	2.3 Ω	150 $^{\circ}C$	D04M65BX1H3	TO220F-3L
XD004M065BX1G3	650V	4A	2.3 Ω	150 $^{\circ}C$	D04M65BX1G3	TO252-2L

Absolute Maximum Ratings (T_c= 25 $^{\circ}C$ unless otherwise noted.)

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	650	V
V_{GSS}	Gate-Source Voltage	± 30	V
I_D	Continuous Drain Current (T _c =25 $^{\circ}C$)	4	A
	Continuous Drain Current (T _c =100 $^{\circ}C$)	2	A
I_{DM}	Pulsed Drain Current	16	A
P_D	Maximum Power Dissipation (T _C =25 $^{\circ}C$,For TO252-2L)	75	W
	Maximum Power Dissipation (T _C =100 $^{\circ}C$,For TO252-2L)	30	W
E_{AS}	Avalanche Energy, Single pulse(L=10mH) (note1)	58	mJ
T_J	Operating Junction Temperature Range	-55 to 150	$^{\circ}C$
T_{STG}	Storage Temperature Range	-55 to 150	$^{\circ}C$

Thermal Data

Symbol	Parameter	Conditoins	Max.	Units
$R_{\theta JC}$	Thermal Resistance-Junction to case (Steady State)	TO220F-3L	4.5	$^{\circ}C/W$
		TO252-2L	1.67	$^{\circ}C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	650	---	---	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	---	---	1	μA
I_{GSS}	Gate Leakage Current, Forward	$V_{GS}=30V, V_{DS}=0V$	---	---	100	nA
	Gate Leakage Current, Reverse	$V_{GS}=-30V, V_{DS}=0V$	---	---	-100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	2	2.88	4	V
$R_{DS(ON)}$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=2A$	--	2.3	2.92	Ω
Q_g	Total Gate Charge	$V_{DS}=520V$	---	12.8	---	nC
Q_{gs}	Gate-Source Charge	$V_{GS}=10V$	---	5.8	---	nC
Q_{gd}	Gate-Drain Charge	$I_{DS}=4A$	---	2.8	---	nC
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=325V, V_{GE}=10V$ $I_{DS}=4A, R_G=10\Omega$	---	10.4	---	nS
t_r	Turn-on Rise Time		--	4	--	nS
$t_{d(off)}$	Turn-off Delay Time		---	21.6	---	nS
t_f	Turn-off Fall Time		---	4	---	nS
C_{iss}	Input Capacitance	$V_{DS}=25V$	---	584	---	pF
C_{oss}	Output Capacitance	$V_{GS}=0V$	---	37	---	pF
C_{rss}	Reverse Transfer Capacitance	$f=1\text{MHz}$	---	27	---	pF

Diode Characteristics of Diode ($T_c=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{SD}	Diode Forward Voltage	$I_{SD}=2A, V_{GS}=0V$	---	---	1.2	V
t_{rr}	Diode Reverse Recovery Time	$V_{DS}=30V, I_{SD}=1A,$ $di_{SD}/dt=100A/\mu s$	---	125	---	ns
Q_{rr}	Diode Reverse Recovery Charge		---	262	---	nC

Notes:

1. $L=10\text{mH}, I_{AS}=3.4A, V_{DD}=50V, R_G=25\Omega,$ Starting $T_J=25^\circ\text{C}.$

Typical Characteristics

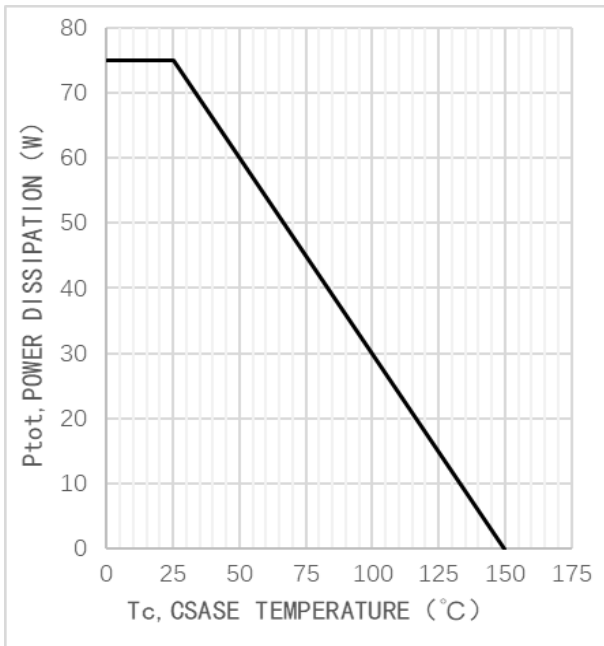


Fig.1 Power Dissipation(For TO252-2L)

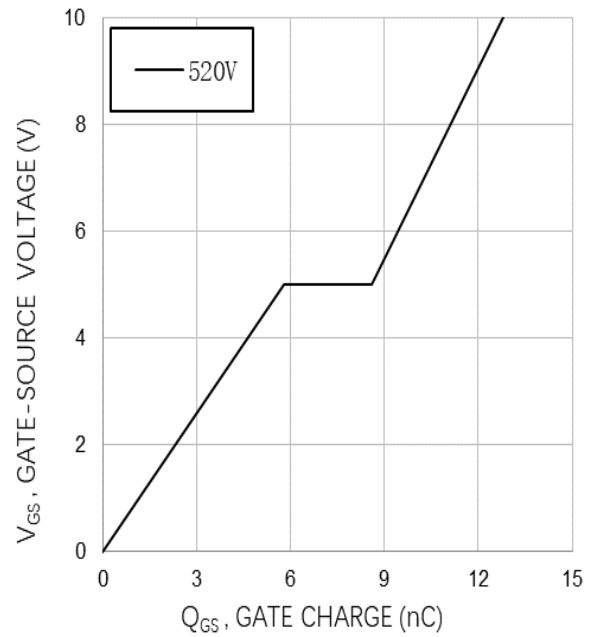


Fig.2 Gate Charge

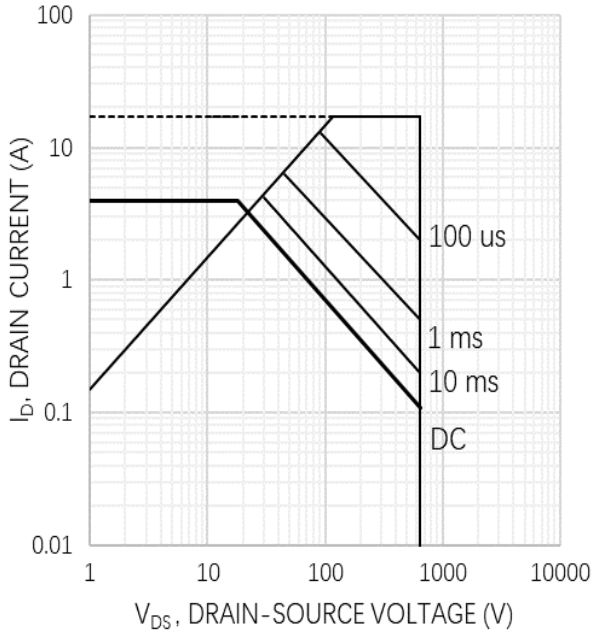


Fig.3 Safe Operation Area

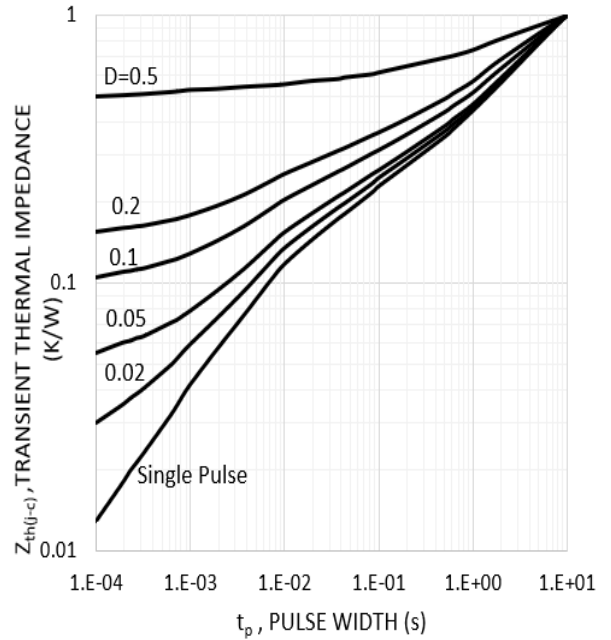


Fig.4 Thermal Transient Impedance

Typical Characteristics

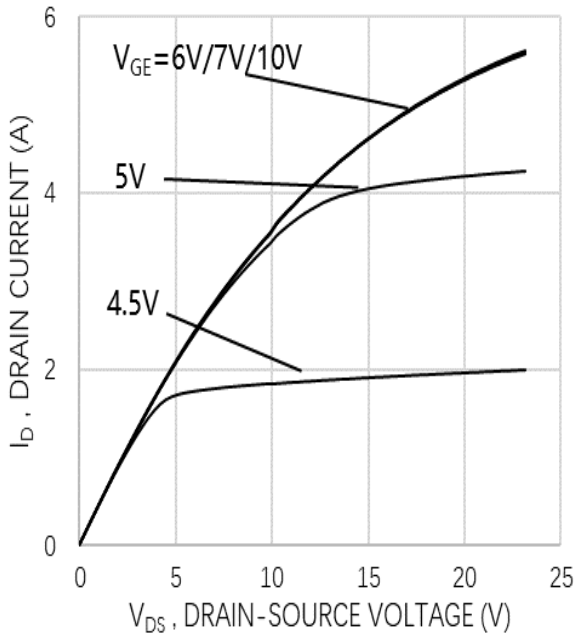


Fig.5 Output Characteristics

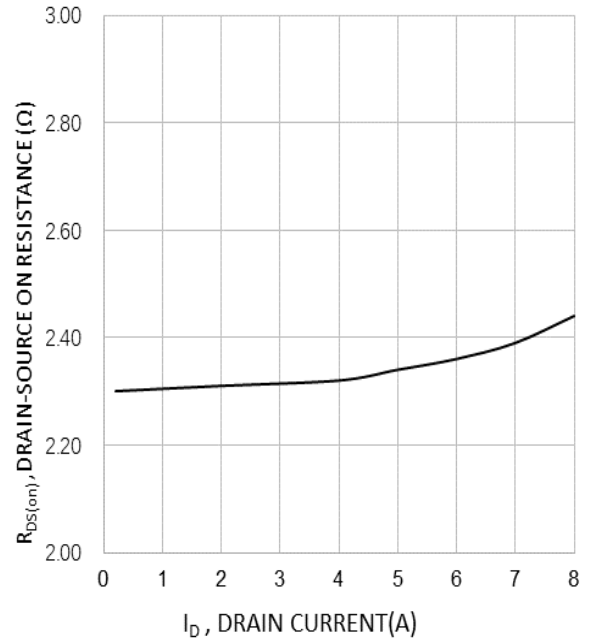


Fig.6 Drain-Source On Resistance

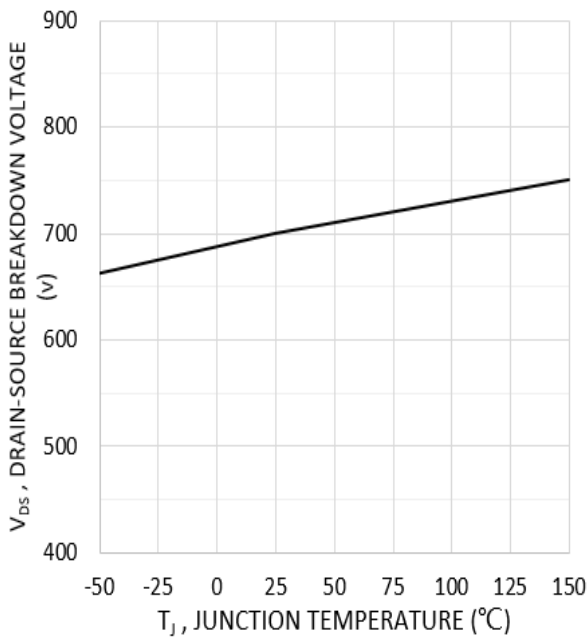


Fig.7 Drain-Source Breakdown Voltage

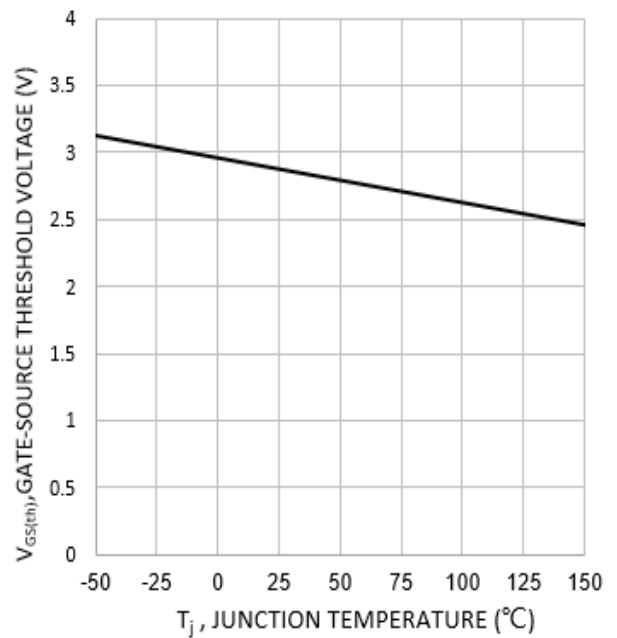


Fig.8 Gate Threshold Voltage

Typical Characteristics

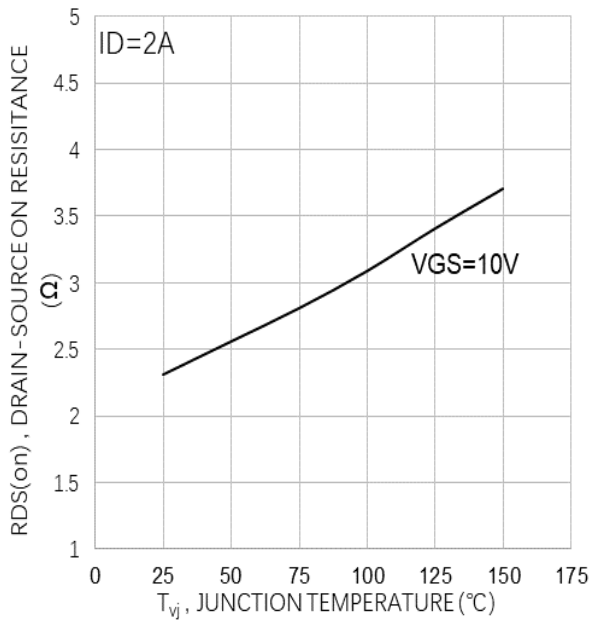


Fig.9 Drain-Source On Resistance

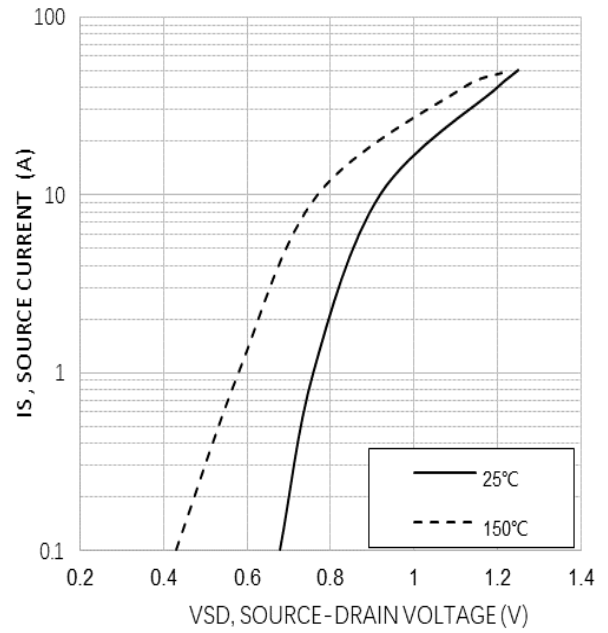


Fig.10 Source-Drain Diode Forward

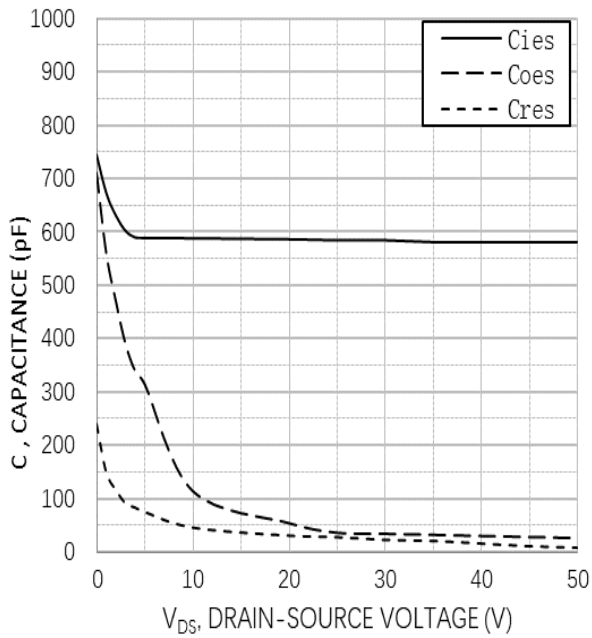
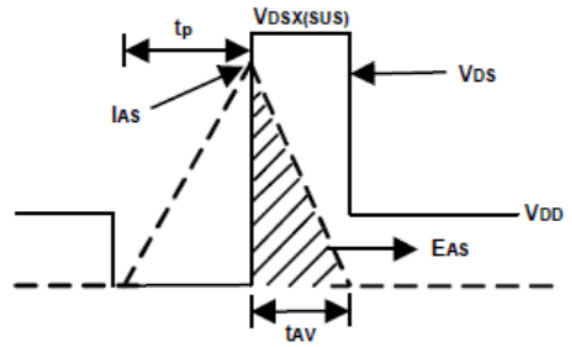
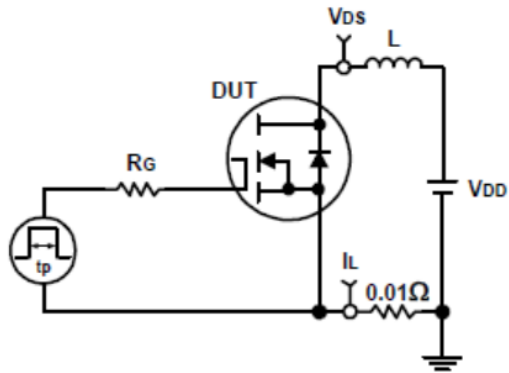
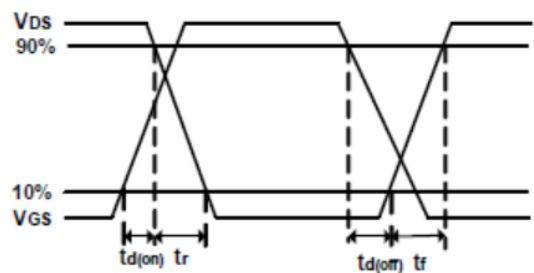
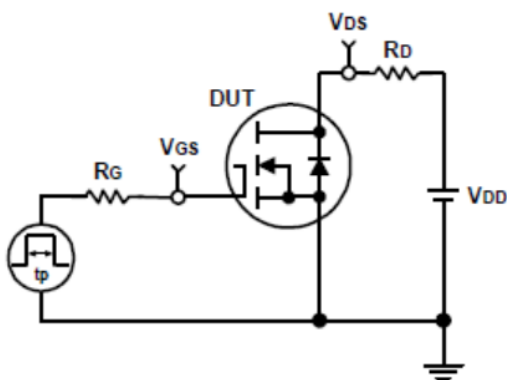


Fig.11 Capacitance

Avalanche Test Circuit and Waveforms

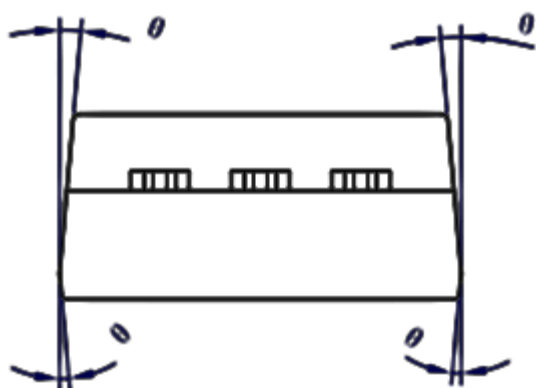
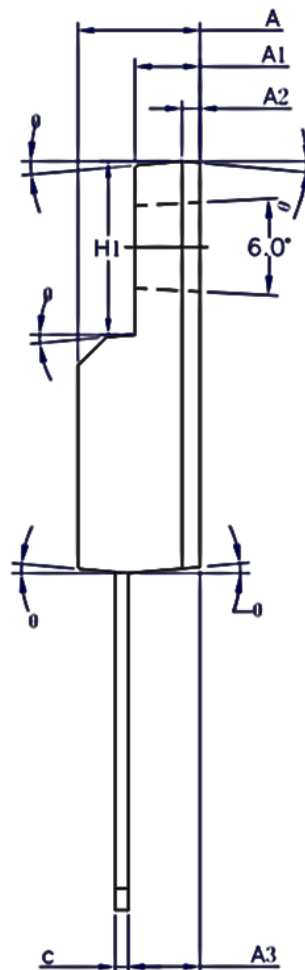
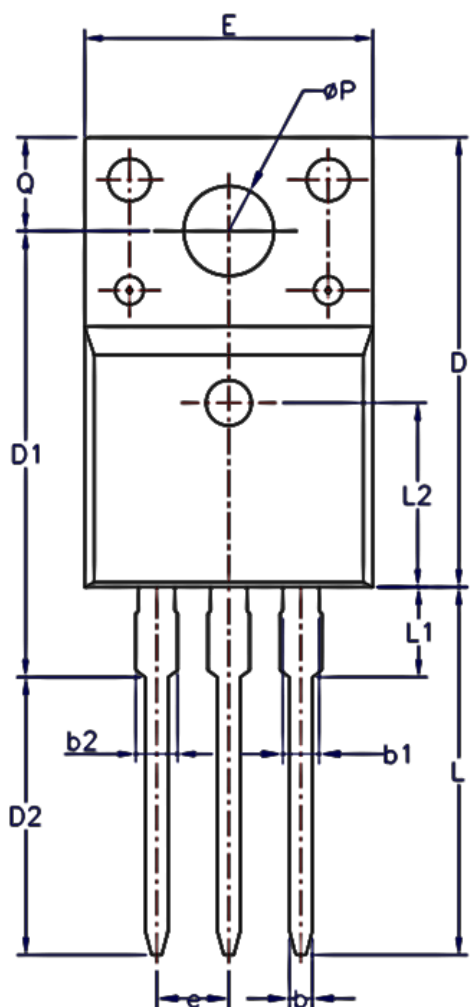


Switching Time Test Circuit and Waveforms



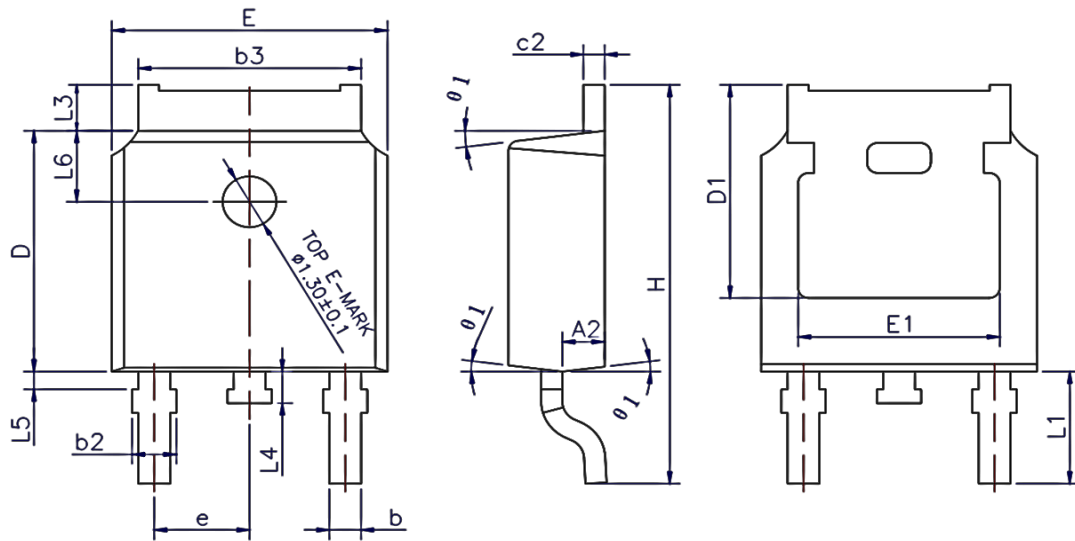
Package Information

TO-220F-3L



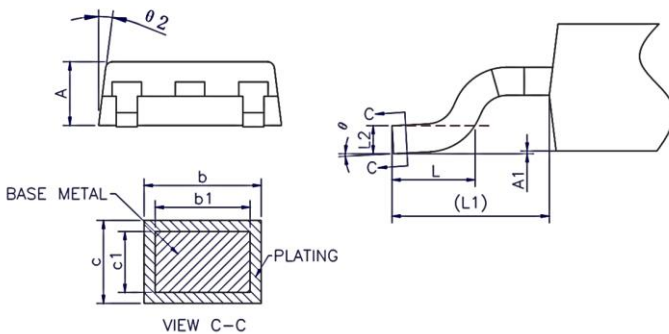
SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	-	0.90
b1	1.18	-	1.38
b2	-	-	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2	6.50REF		
øP	3.08	3.18	3.28
Q	3.20	-	3.40
θ1	1°	3°	5°

TO-252-2L



COMMON DIMENSIONS
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	---	0.10
A2	0.90	1.01	1.10
b	0.72	---	0.85
b1	0.71	0.76	0.81
b2	0.72	---	0.90
b3	5.13	5.33	5.46
c	0.47	---	0.60
c1	0.46	0.51	0.56
c2	0.47	---	0.60
D	6.00	6.10	6.20
D1	5.25	---	---
E	6.50	6.60	6.70
E1	4.70	---	---
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	---	1.25
L4	0.60	0.80	1.00
L5	0.15	---	0.75
L6	1.80 REF		
θ	0°	---	8°
$\theta 1$	5°	7°	9°
$\theta 2$	5°	7°	9°



NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD
TO-252 AA DO NOT INCLUDE MOLD FLASH OR
PROTRUSIONS

Revision History

Ver.	Date	Change Notice
1.0	2022/05/20	Release