

650V 4A Advanced N-Ch Power MOSFET

FEATURES

- Low drain-source On resistance : $R_{DS(on)} = 2.4\Omega$ (Typ.)
- Low gate charge : $Q_g = 12nC$ (Typ.)
- Low reverse transfer capacitance : $C_{rss} = 12pF$ (Typ.)
- Lower EMI Noise
- RoHS compliant device
- 100% avalanche tested

Marking Information

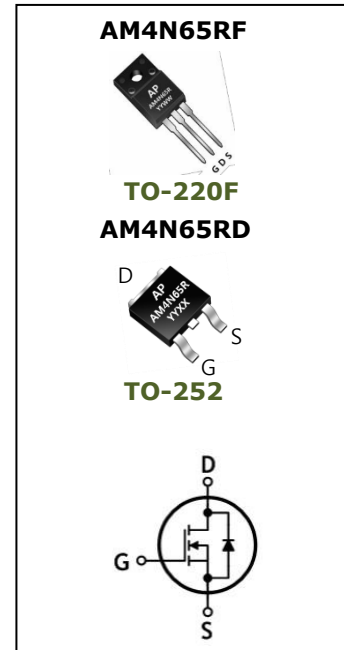
Row 1 : AP

Row 2 : Product Information

Row 3 : Date Code

- YY : Year Code

- WW : Week Code



Ordering Information

Part No.	Package	Packing	Finish	Halogen	Packing Unit
AM4N65RF	TO-220F	Tube	Sn	Free	5,000ea
AM4N65RD	TO-252	Tape & Reel	Sn	Free	2,500ea

Maximum Ratings (Tc=25 °C, unless otherwise noted)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V_{DS}	650	V
Gate-source voltage	V_{GS}	± 30	V
Drain current (DC)*	I_D	$T_C = 25^\circ C$	A
		$T_C = 100^\circ C$	
Drain current (Pulsed)*	I_{DM}	16	A
Power Dissipation	P_D	TO-220F	W
		TO-252	
Typical Thermal Resistance Package = TO-220F	$R_{\theta JC}$	2.5	$^\circ C / W$
Single pulsed avalanche energy (Note 2)	E_{AS}	173	mJ
Avalanche current (Repetitive) (Note 1)	I_{AR}	4	A
Repetitive avalanche energy (Note 1)	E_{AR}	3.2	mJ
Junction temperature	T_J	150	$^\circ C$
Storage temperature range	T_{stg}	-55~150	

*Limited only maximum junction temperature

REV. 01

Thermal Characteristic

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to case	$R_{th(j-c)}$	Max. 3.9	°C/W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	Max. 62.5	

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

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DS}	$I_D = 250\mu\text{A}$, $V_{GS} = 0$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$I_D = 250\mu\text{A}$, $V_{DS} = V_{GS}$	2	-	4	V
Drain-source cut-off current	I_{DSS}	$V_{DS} = 650\text{V}$, $V_{GS} = 0\text{V}$	-	-	1	μA
		$V_{DS} = 650\text{V}$, $T_C = 150^{\circ}\text{C}$	-	-	100	
Gate leakage current	I_{GSS}	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 30\text{V}$	-	-	± 100	nA
Drain-source on-resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{V}$, $I_D = 2\text{A}$	-	2.4	3	Ω
Forward transfer conductance (Note 3)	g_{fs}	$V_{DS} = 10\text{V}$, $I_D = 2\text{A}$	-	4.4	-	S
Input capacitance	C_{iss}	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$, $f = 1.0\text{MHz}$	-	707	-	pF
Output capacitance	C_{oss}		-	46	-	
Reverse transfer capacitance	C_{rss}		-	3.6	-	
Turn-on delay time (Note 3,4)	$T_{d(on)}$	$V_{DS} = 325\text{V}$, $I_D = 4\text{A}$, $R_G = 25\Omega$	-	62	-	ns
Rise time (Note 3,4)	T_r		-	81	-	
Turn-off delay time (Note 3,4)	$t_{d(off)}$		-	109	-	
Fall time (Note 3,4)	t_f		-	46	-	
Total gate charge (Note 3,4)	Q_g	$V_{DS} = 520\text{V}$, $V_{GS} = 10\text{V}$, $I_D = 4\text{A}$	-	12	16	nC
Gate-source charge (Note 3,4)	Q_{gs}		-	5	-	
Gate-drain charge (Note 3,4)	Q_g		-	2.5	-	

Source-Drain Diode Ratings and Characteristics ($T_C=25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Source current (DC)	I_S	Integral reverse diode in the MOSFET	-	-	4	A
Source current (Pulsed)	I_{SM}		-	-	16	A
Forward voltage	V_{SD}	$V_{GS} = 0\text{V}$, $I_S = 2\text{A}$	-	-	1.4	V
Reverse recovery time (Note 3,4)	t_{rr}	$I_S = 4\text{A}$, $V_{GS} = 0\text{V}$ $dI_F/dt = 100\text{A}/\mu\text{s}$	-	487	-	ns
Reverse recovery charge (Note 3,4)	Q_{rr}		-	1.27	-	μC

Note :

1. Repetitive rating : Pulse width limited by maximum junction temperature.
2. $L=20\text{mH}$, $I_{AS}=4\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$
3. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature



Typical Electrical Characteristic

Fig. 1 Typical Output Characteristics

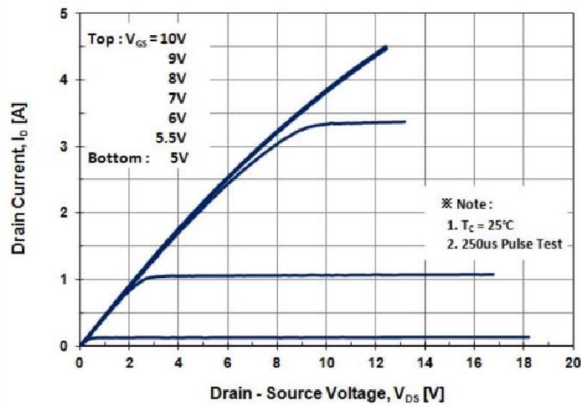


Fig. 2 Typical Output Characteristics

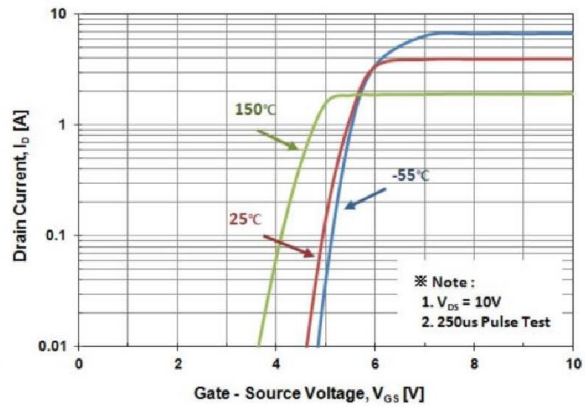


Fig.3 On-Resistance Variation with Drain Current and Gate Voltage

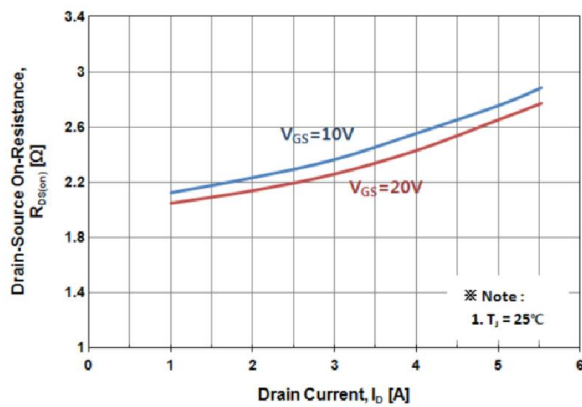


Fig. 4 Body Diode Forward Voltage Variation with Source Current

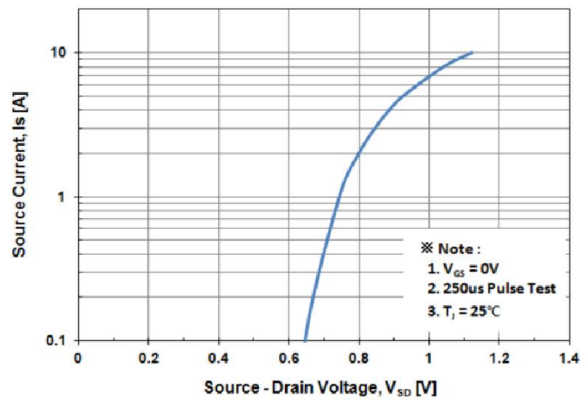


Fig. 5 Typical Capacitance Characteristics

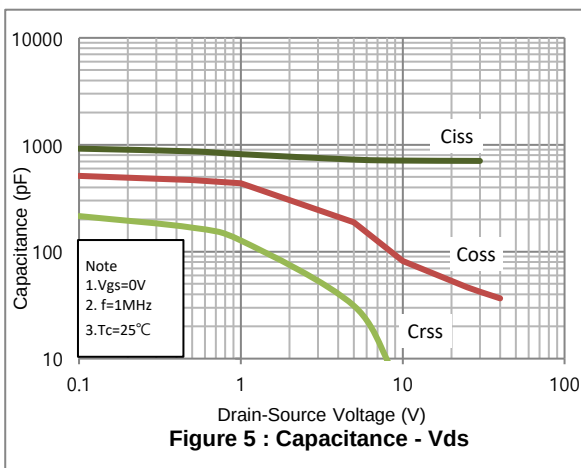
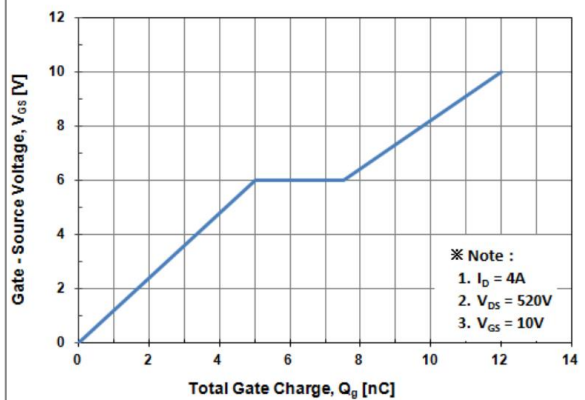


Fig. 6 Typical Total Gate Charge Characteristics





Typical Electrical Characteristic

Fig. 7 Breakdown Voltage Variation vs. Temperature

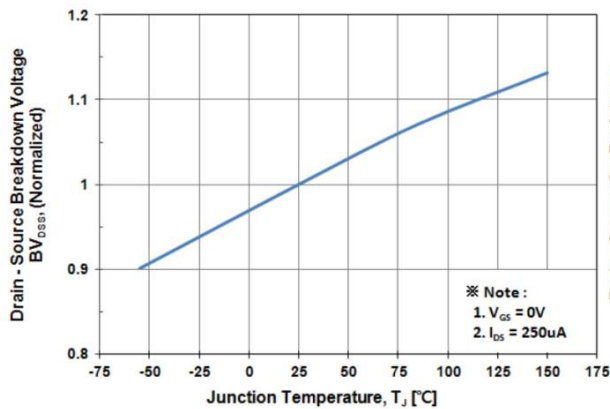


Fig. 8 On-Resistance Variation vs. Temperature

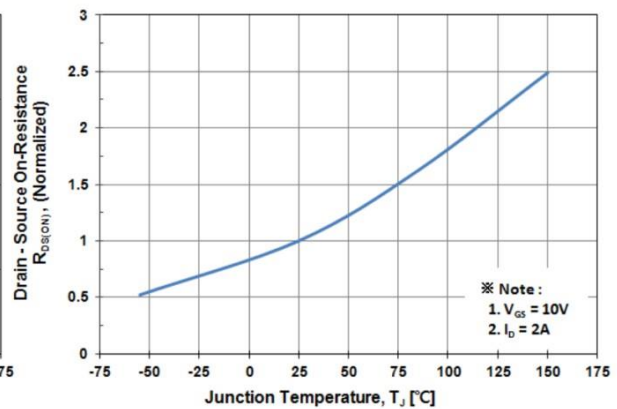


Fig. 9 Maximum Drain Current vs. Case Temperature

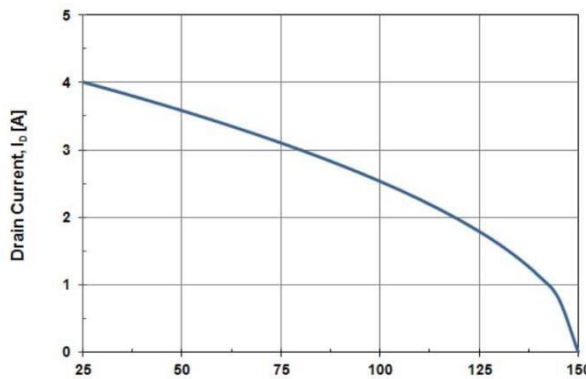


Fig. 10 Maximum Safe Operating Area

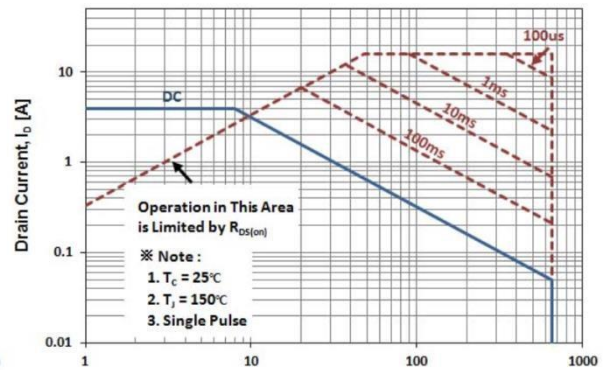


Fig. 11 Transient Thermal Impedance

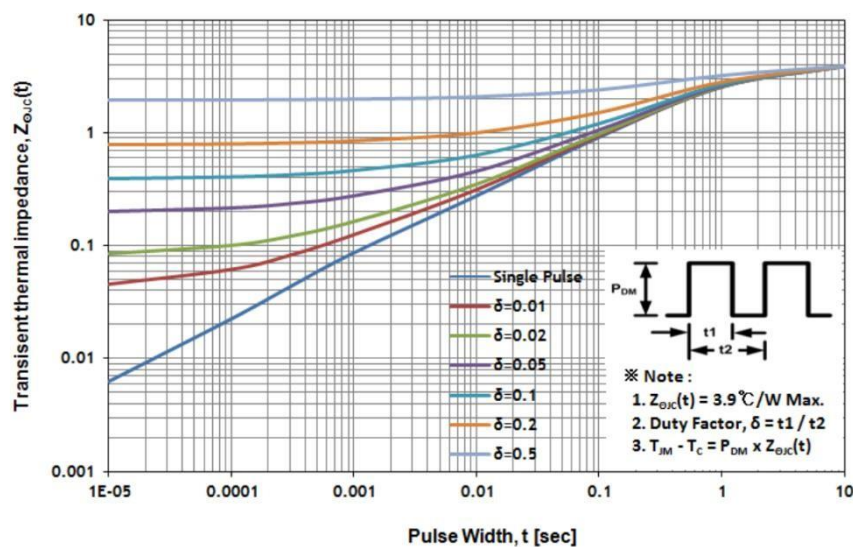


Fig. 12 Gate Charge Test Circuit & Waveform

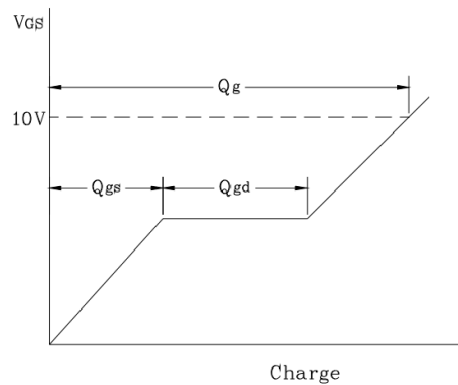
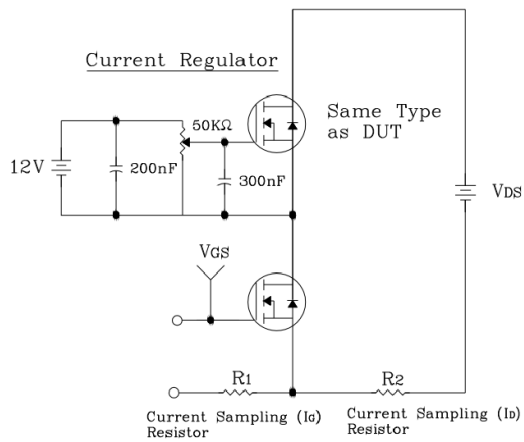


Fig. 13 Resistive Switching Test Circuit & Waveform

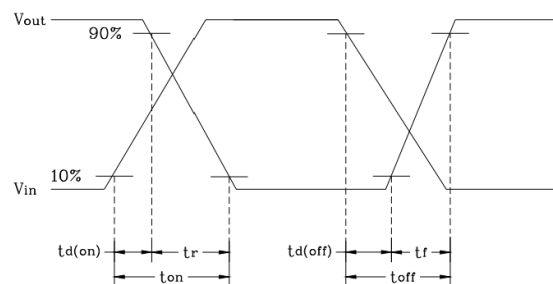
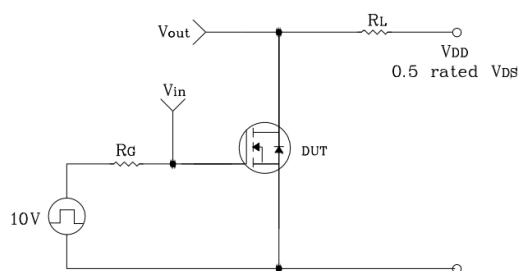


Fig. 14 E_{AS} Test Circuit & Waveform

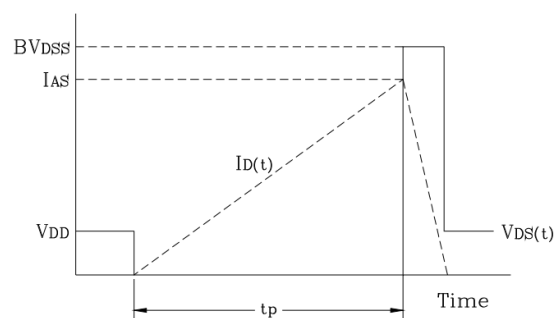
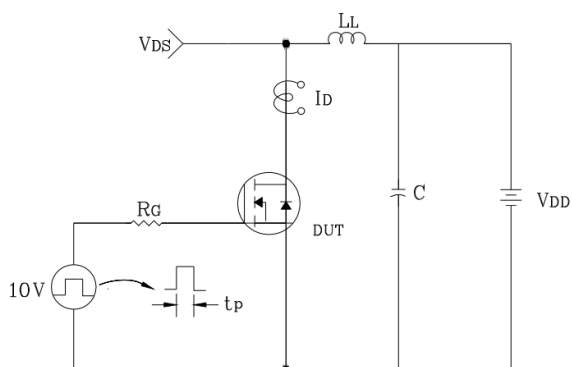
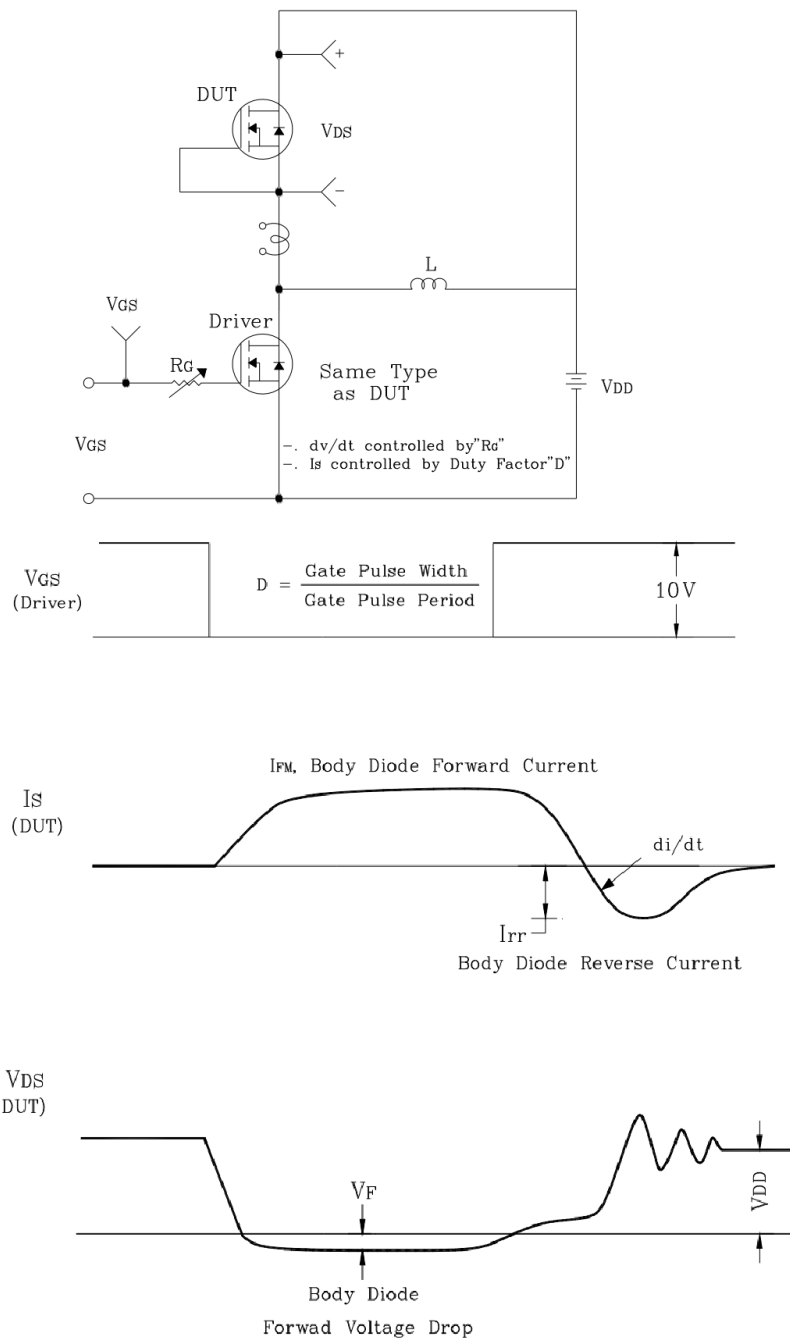


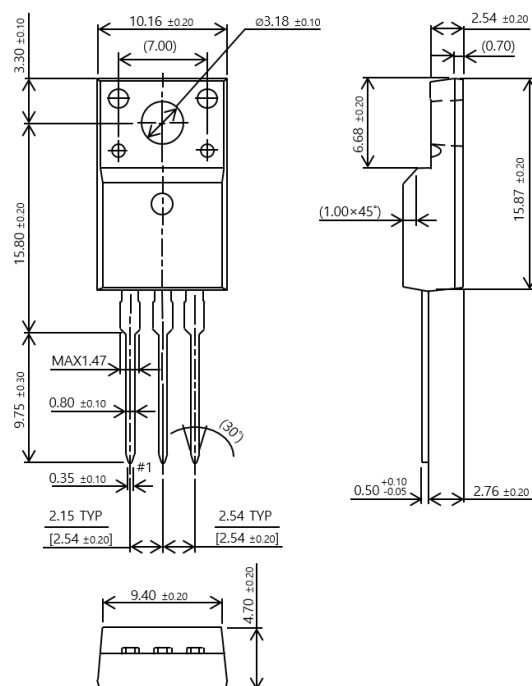
Fig. 15 Diode Reverse Recovery Time Test Circuit & Waveform



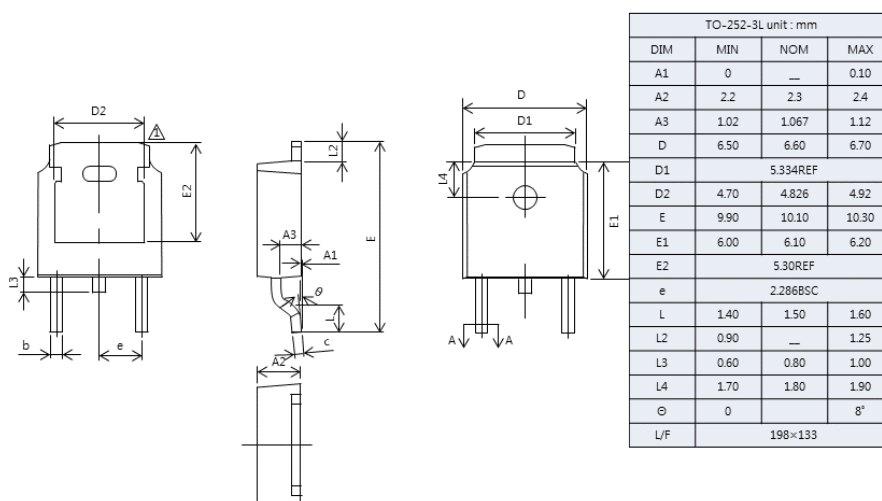


Package Dimensions

TO-220F



TO-252



Revision History

No	Date	Contents
0	2016-09-17	Initial Brief Datasheet Release
1	2019-03-22	$R_{\theta JC}$, P_D Update

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