

650V 380mΩ N-Channel Power MOSFET

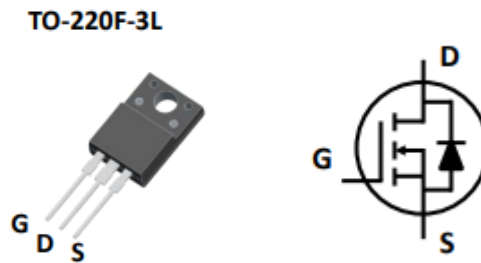
Features

- Multi-Epi Super Junction MOSFET
- Fast Switching
- Easy to Drive/Use
- Ultra-Fast Body Diode

Applications

- Switching Mode Power Supply
- DC/DC Converter
- Charger / Power Supply

Pin Description



Absolute Ratings ($T_A = 25^\circ\text{C}$ in a TO-220F package unless otherwise noted)

Parameter	Symbol	Value	Units
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current, $T_C = 25^\circ\text{C}$	I_{DS}	9	A
Pulsed Drain Current	$I_{DS, pulse}$	22	A
Total Power Dissipation	P_D	72	W
Operating Junction Temperature Range	T_J	-40 to 150	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-40 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Value	Units
Thermal Resistance Junction-Case	$R_{\theta JC}$	1.73	$^\circ\text{C}/\text{W}$

Electrical Characteristics

Static ($T_J=25^{\circ}\text{C}$ unless otherwise specified)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	650	---	---	V
Gate-Body Leakage Current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	---	---	± 70	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V$	---	0.2	---	μA
		$V_{DS} = 650V, V_{GS} = 0V, T_J = 125^{\circ}\text{C}$	---	11	---	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 2.5A$	---	360	380	m Ω
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.2	---	3.8	V
Gate Resistance	R_G	$f = 1\text{MHz}, \text{Open Drain}$	---	10.8	---	Ω
Dynamic ($T_J=25^{\circ}\text{C}$ unless otherwise specified)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Input Capacitance	C_{iss}	$V_{GS} = 0V, V_{DS} = 400V,$ $f = 250\text{KHz}$	---	676	---	μF
Output Capacitance	C_{oss}		---	18.7	---	
Reverse Transfer Capacitance	C_{rss}		---	1.3	---	
Total Gate Charge	Q_g	$V_{DS} = 400V, I_D = 2.5A,$ $V_{GS} = 0-12V$	---	3.9	---	nC
Gate-Source Charge	Q_{gs}		---	8.0	---	
Gate-Drain Charge	Q_{gd}		---	20	---	
Gate Plateau Voltage	V_{Plat}		---	4.1	---	
Turn-on delay time	$T_{d(on)}$	$V_{DS} = 400V, I_D = 2.5A,$ $V_{GS} = 12V, R_G = 10\Omega$	---	23	---	nS
Rise time	T_r		---	15	---	
Turn-off delay time	$T_{d(off)}$		---	86	---	
Fall time	T_f		---	33	---	
Body Diode Reverse Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise specified)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Diode Forward Voltage	V_{SD}	$V_{GS} = 0V, I_F = 2.5A,$	---	0.78	---	V
Reverse Recovery Time	t_{rr}	$V_{DS} = 400V, I_S = 2.5A,$ $di_F / dt = 100A / \mu S$	---	199	---	nS
Reverse Recovery Charge	Q_{rr}		---	1.3	---	μC
Peak Reverse Recovery Current	I_{rrm}		---	13.5	---	A

Typical Characteristics

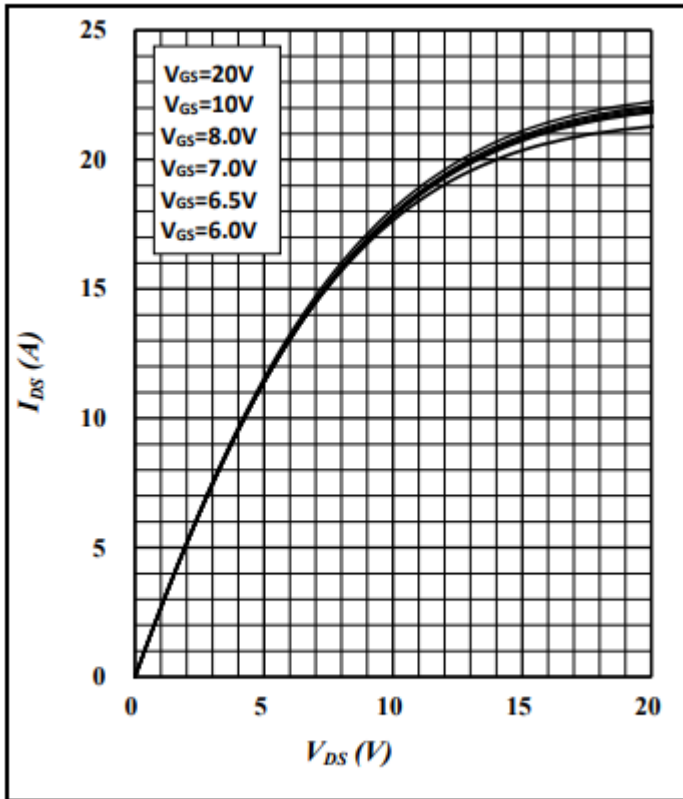


Fig.1 Typ. Output Characteristics $T_j = 25\text{ }^\circ\text{C}$

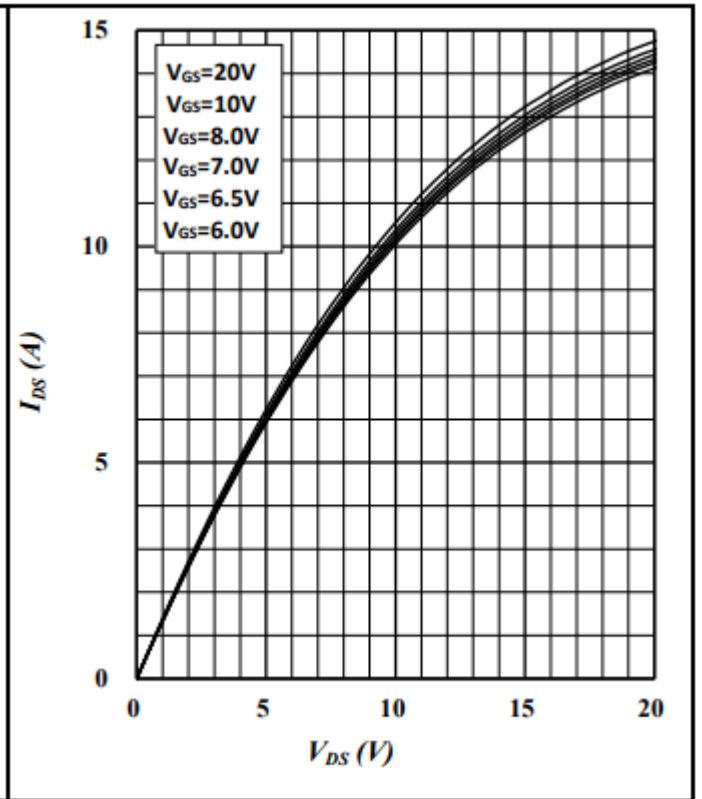


Fig.2 Typ. Output Characteristics $T_j = 125\text{ }^\circ\text{C}$

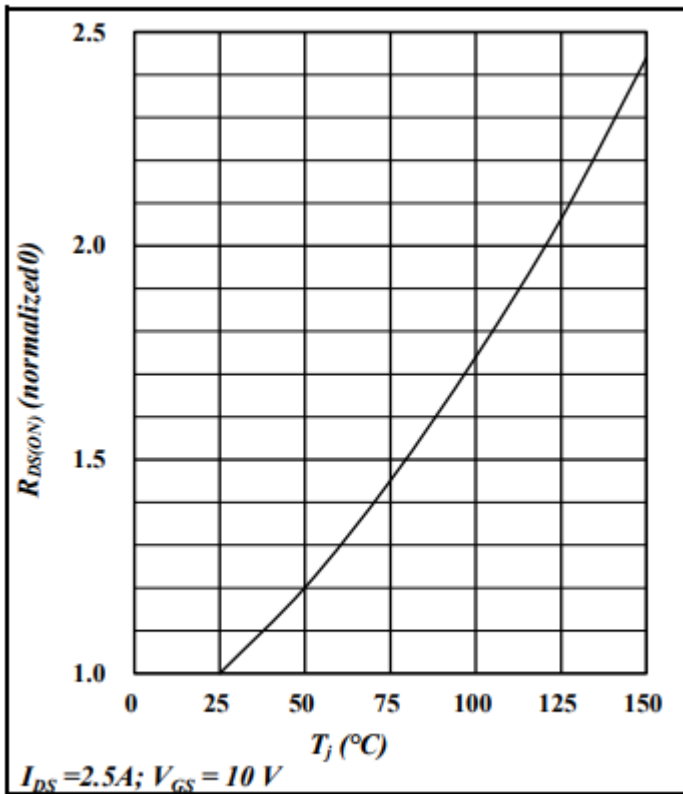


Fig.3 $R_{DS(ON)}$ vs. Junction Temperature

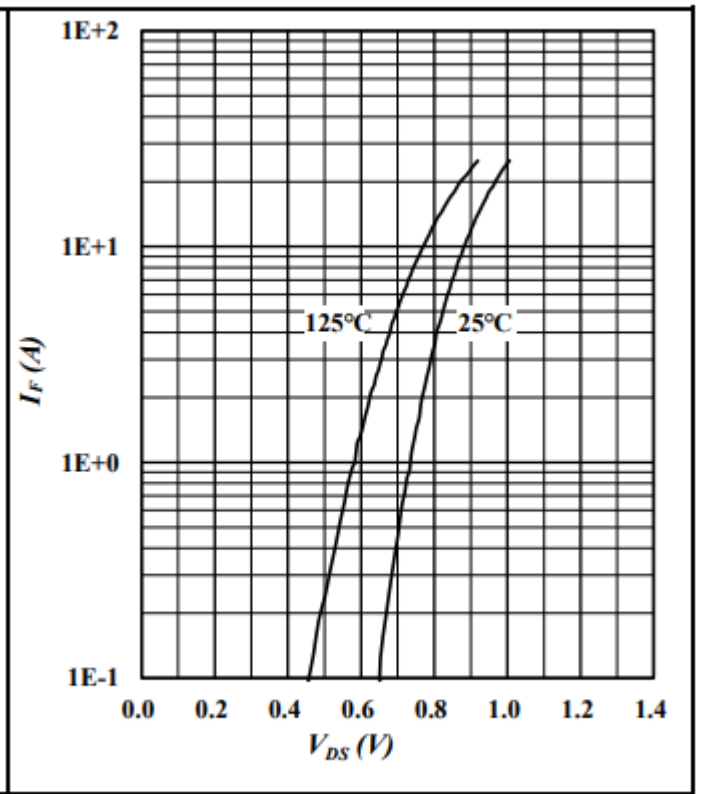


Fig.4 Forward Characteristics of Body Diode

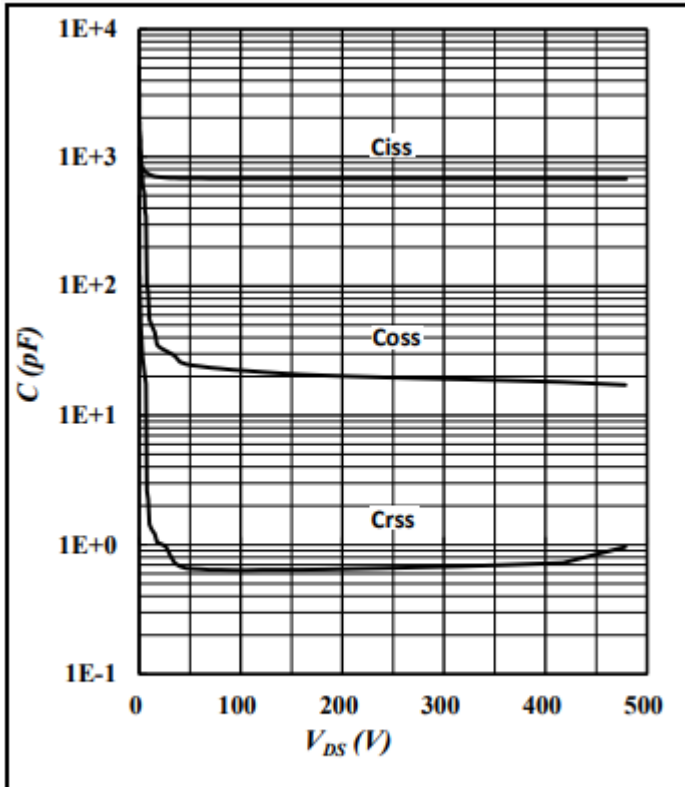
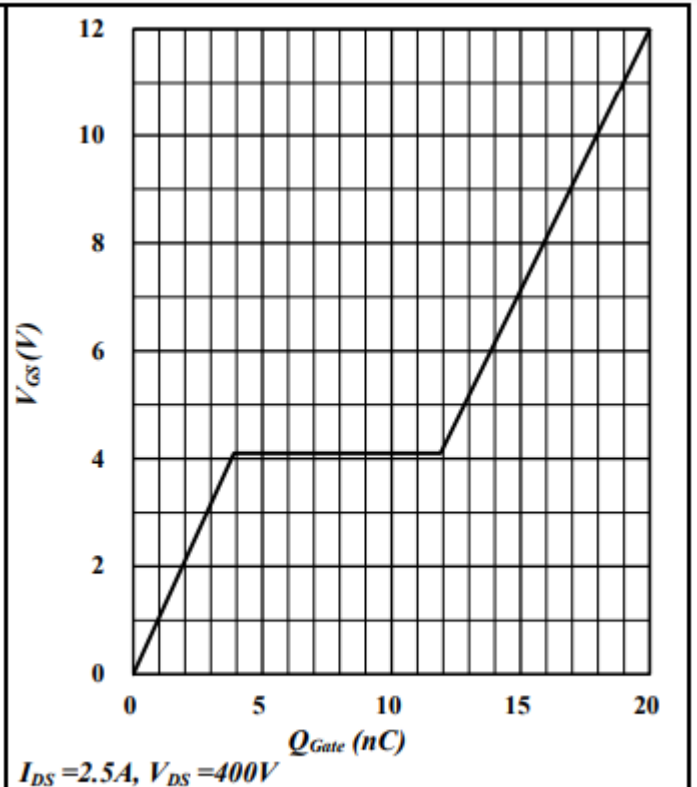
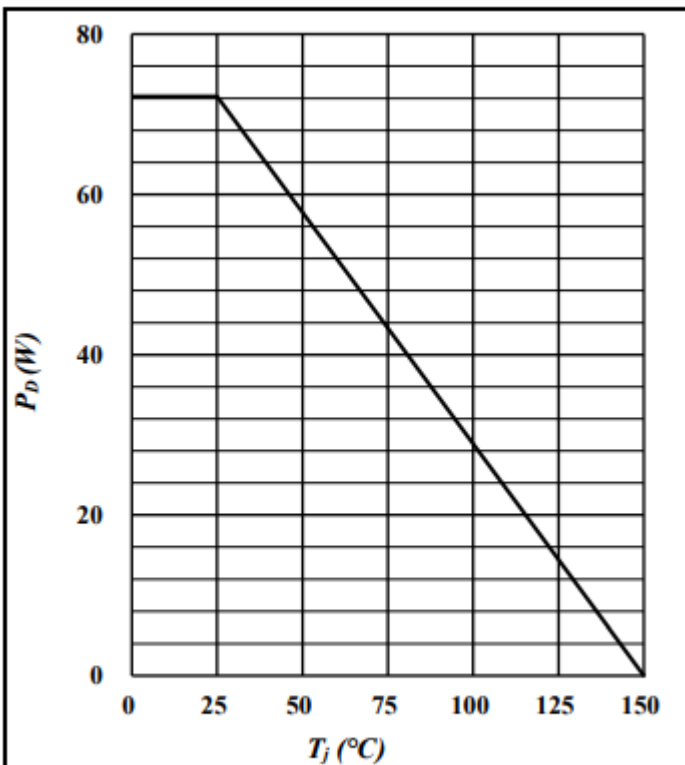


Fig.5 Typ. Capacitance vs. V_{DS}



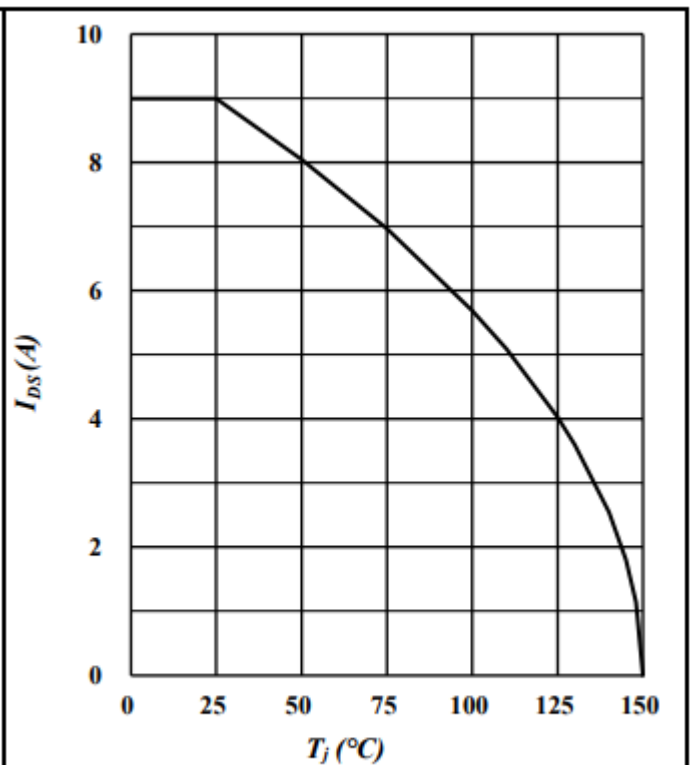
$I_{DS}=2.5A, V_{DS}=400V$

Fig.6 Typ. Gate Charge



Package TO-220FP-3L

Fig.7 Power Dissipation Derating Curve



Package TO-220FP-3L

Fig.8 Drain Current Derating Curve

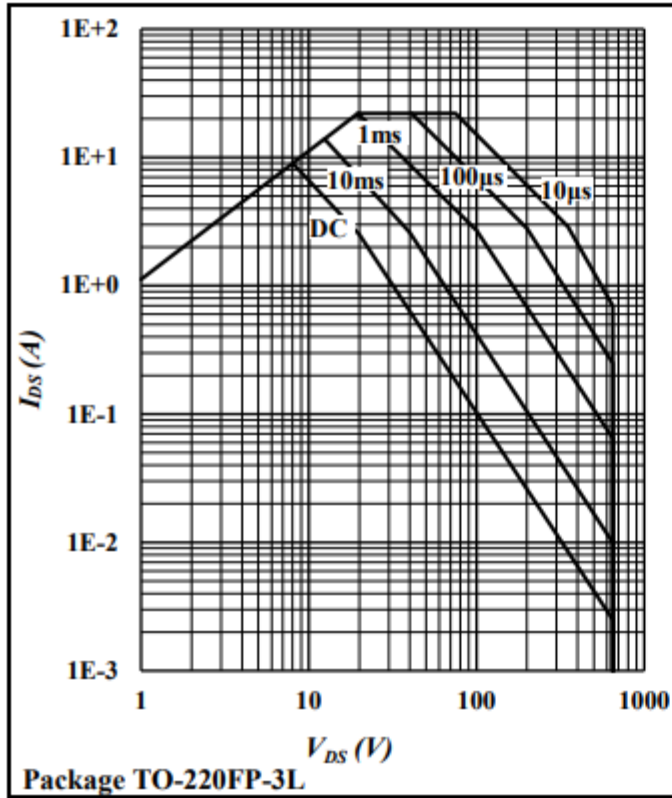


Fig.9 Safe Operating Area

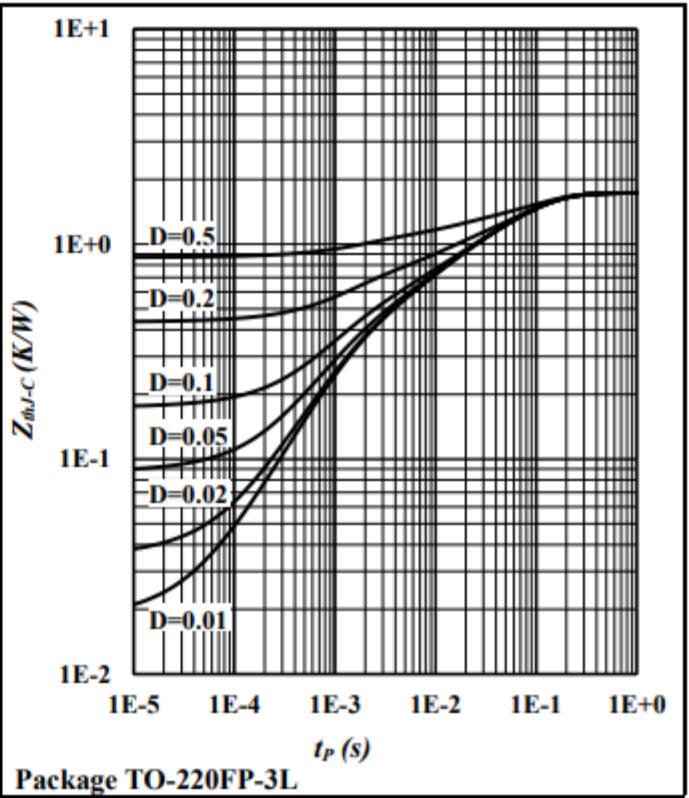


Fig.10 Z_{thJ-C} , $D = tP / T$

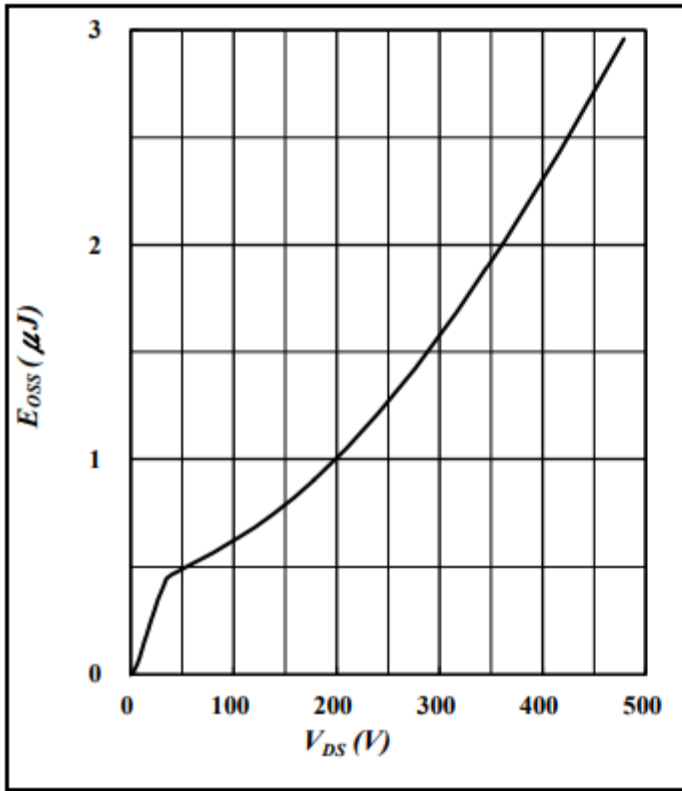
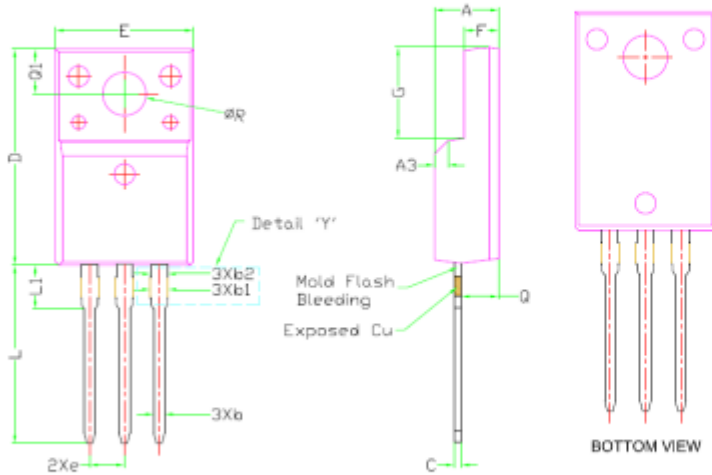


Fig.11 Eoss Curve

Package Information

TO-220FP-3L



SYMBOL	DIMENSIONS		
	Mln.	Nom.	Max.
A	4.60	4.70	4.80
b	0.70	0.80	0.91
b1	1.20	1.30	1.47
b2	1.10	1.20	1.30
C	0.45	0.50	0.63
D	15.80	15.87	15.97
e	2.54		
E	10.00	10.10	10.30
F	2.44	2.54	2.64
G	6.50	6.70	6.90
L	12.90	13.10	13.30
L1	3.13	3.23	3.33
Q	2.65	2.75	2.85
Q1	3.20	3.30	3.40
ΦR	3.08	3.18	3.28