

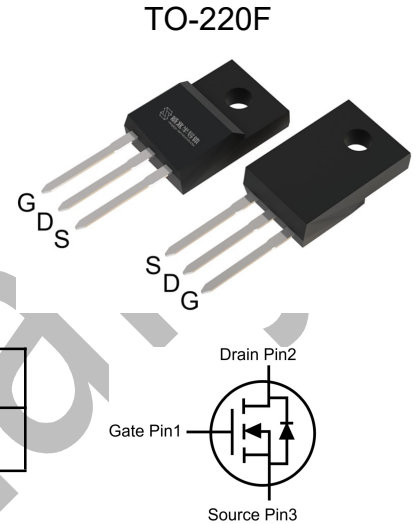
Features

- Enhancement mode
- Super junction technology
- 100% Avalanche Tested, 100% Rg Tested

V_{DS}	600	V
$R_{DS(on),TYP@ V_{GS}=10V}$	140	mΩ
$I_D(\text{Silicon limited})$	20	A



Part ID	Package Type	Marking	Packing
VSF60R180S	TO-220F	F60R180S	50pcs/Tube



Maximum ratings, at $T_A = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter		Rating	Unit
V(BR)DSS	Drain-source breakdown voltage		600	V
VGS	Gate-source voltage		±30	V
IS	Diode continuous forward current (Silicon limited)①	TC = 25°C	20	A
ID	Continuous drain current @VGS=10V (Silicon limited)①	TC = 25°C	20	A
ID	Continuous drain current @VGS=10V (Silicon limited)①	TC = 100°C	12	A
IDM	Pulse drain current tested ②	TC = 25°C	80	A
IDSM	Continuous drain current @VGS=10V	TA = 25°C	2.4	A
		TA=70°C	1.9	A
EAS	Maximum Avalanche energy, single pulsed ③		101	mJ
PD	Maximum power dissipation ④	TC = 25°C	78	W
		TC = 100°C	31	W
PDSM	Maximum power dissipation ⑤	TA = 25°C	2.5	W
		TA = 70°C	1.6	W
TJ,TSTG	Operating junction and storage temperature range		-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Typical	Max	Unit
$R_{\theta JC}$	Thermal resistance, junction-to-case ⑥	1.3	1.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal resistance, junction-to-ambient ⑦	42	50	$^\circ\text{C/W}$

Electrical Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Static Electrical Characteristics @ T _J =25°C (unless otherwise stated)						
V(BR)DSS	Drain-source breakdown voltage	V _{GS} =0V, I _D =250μA	600	--	--	V
I _{DSS}	Zero gate voltage drain current(T _J =25°C)	V _{DS} =600V,V _{GS} =0V	--	--	1	μA
	Zero gate voltage drain current(T _J =125°C) ⑧	V _{DS} =600V,V _{GS} =0V	--	--	100	μA
I _{GSS}	Gate-body leakage current	V _{GS} =±30V,V _{DS} =0V	--	--	±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} =V _{GS} ,I _D =250μA	2.5	3	3.5	V
R _{DS(on)}	Drain-source on-state resistance ⑨	V _{GS} =10V, I _D =10A	--	140	180	mΩ
		(T _J =100°C) ⑧	--	249	--	mΩ
G _{FS}	Forward transconductance	V _{DS} =15V, I _D =10A	--	17	--	S
Dynamic Electrical Characteristics @ T _J = 25°C (unless otherwise stated)						
C _{iss}	Input capacitance ⑧	V _{DS} =400V,V _{GS} =0V, f=100kHz	--	1275	--	pF
C _{oss}	Output capacitance ⑧		--	30	--	pF
C _{rss}	Reverse transfer capacitance ⑧		--	1	--	pF
C _{o(er)}	Output capacitance,energy related ⑧⑩	V _{DS} =0V to 400V	--	49	--	pF
C _{o(tr)}	Output capacitance,time related ⑧⑪	V _{GS} =0V	--	271	--	pF
R _g	Gate resistance	f=1MHz	--	3.9	--	Ω
Q _g	Total gate charge ⑧	V _{DS} =400V,I _D =10A, V _{GS} =10V	--	25	--	nC
Q _{gs}	Gate-source charge ⑧		--	6.1	--	nC
Q _{gd}	Gate-drain charge ⑧		--	6.6	--	nC
Q _{oss}	Output charge ⑧	V _{DS} =0V to 400V V _{GS} =0V	--	109	--	nC
Switching Characteristics ⑧						
T _{d(on)}	Turn-on delay time	V _{DD} =400V, I _D =10A, R _G =10Ω, V _{GS} =10V	--	11	--	ns
T _r	Turn-on rise time		--	9.2	--	ns
T _{d(off)}	Turn-off delay time		--	60	--	ns
T _f	Turn-off fall time		--	35	--	ns
Source- Drain Diode Characteristics@ T _J = 25°C (unless otherwise stated)						
V _{SD}	Forward on voltage	I _{SD} =10A,V _{GS} =0V	--	0.85	1	V
T _{rr}	Reverse recovery time ⑧	V _{DD} =50V, I _{sd} =10A, V _{GS} =0V	--	244	--	ns
Q _{rr}	Reverse recovery charge ⑧	di/dt=100A/μs	--	2.8	--	uC

NOTE: ① Drain current limited only by maximum junction temperature; TO-220AB equivalent.

② Single pulse; pulse width limited by $T_J(\text{max})$.

③ This maximum value is based on starting $T_J = 25^{\circ}\text{C}$, $L = 10\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 4.5A$, $V_{GS}=10V$; 100% FT tested at $L = 10\text{mH}$, $I_{AS} = 3A$.

④ The power dissipation P_d is based on $T_J(\text{max})$, using junction-to-case thermal resistance $R_{\theta JC}$.

⑤ The power dissipation P_{dsM} is based on $T_J(\text{max})$, using junction-to-ambient thermal resistance $R_{\theta JA}$.

⑥ Thermal resistance from junction to case, this test is performed on a cold plate.

⑦ The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A = 25^{\circ}\text{C}$.

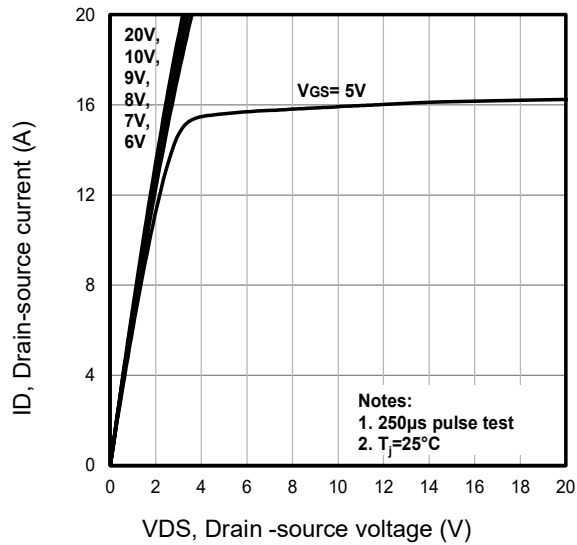
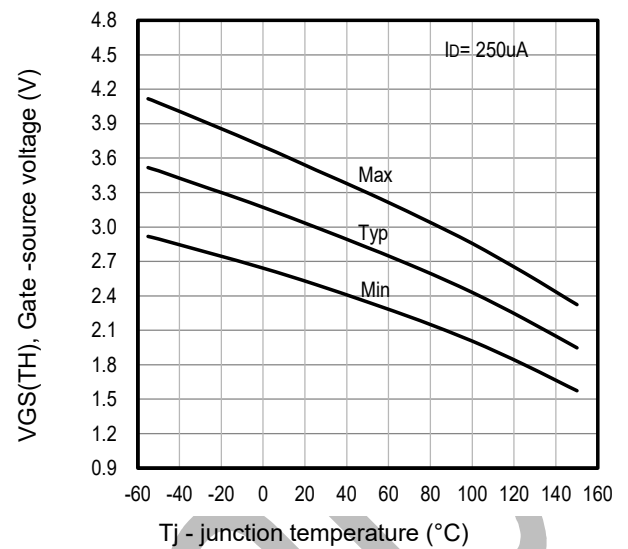
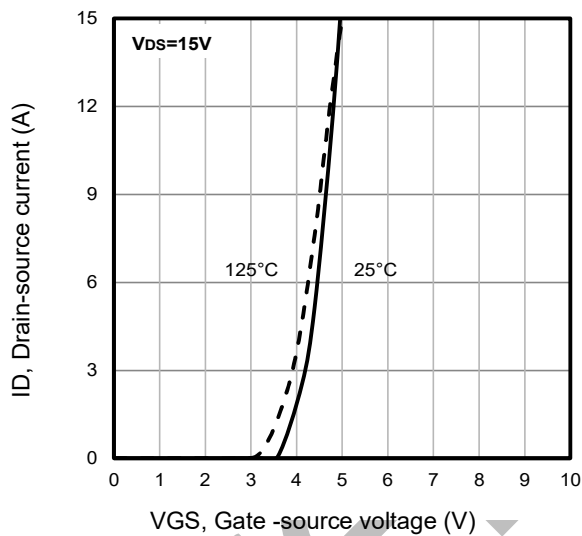
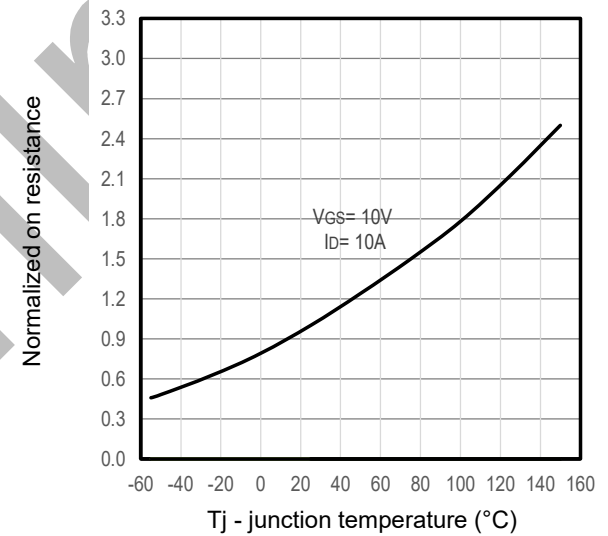
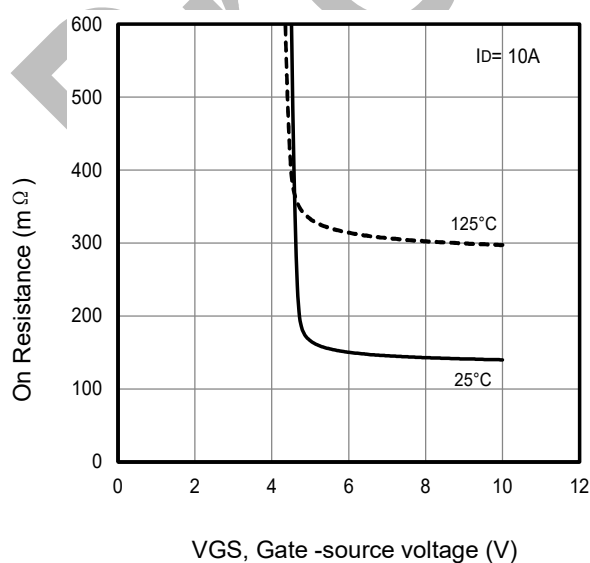
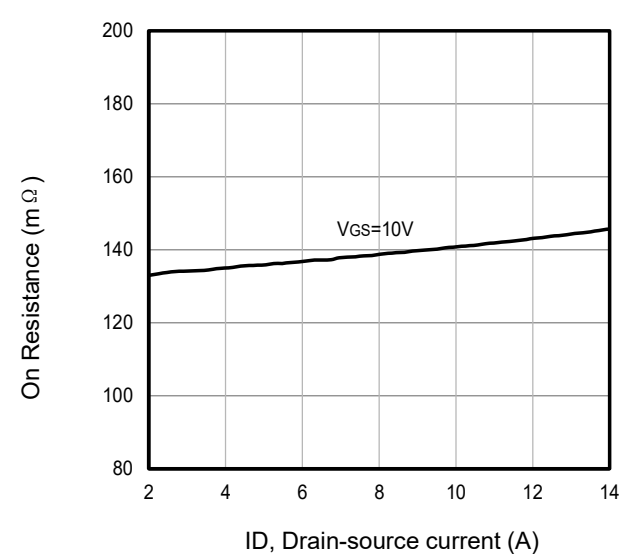
⑧ Guaranteed by design, not subject to production testing.

⑨ Pulse width $\leq 380\mu s$; duty cycles $\leq 2\%$.

⑩ Equivalent capacitance to give same stored energy from 0V to 400V.

⑪ Equivalent capacitance to give same charging time from 0V to 400V.

Typical Characteristics


Fig1. Typical output characteristics

Fig2. Typical $V_{GS(TH)}$ gate-source voltage Vs. T_j

Fig3. Typical transfer characteristics

Fig4. Typical normalized on-resistance Vs. T_j

Fig5. Typical on resistance Vs gate-source voltage

Fig6. Typical on resistance Vs drain current

Typical Characteristics

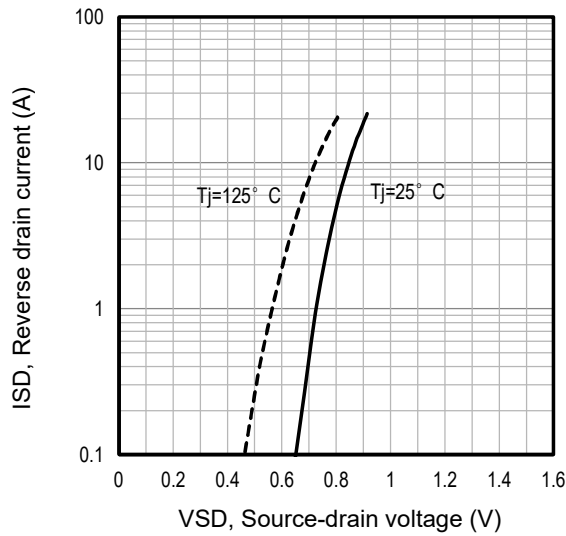


Fig7. Typical source-drain diode forward voltage

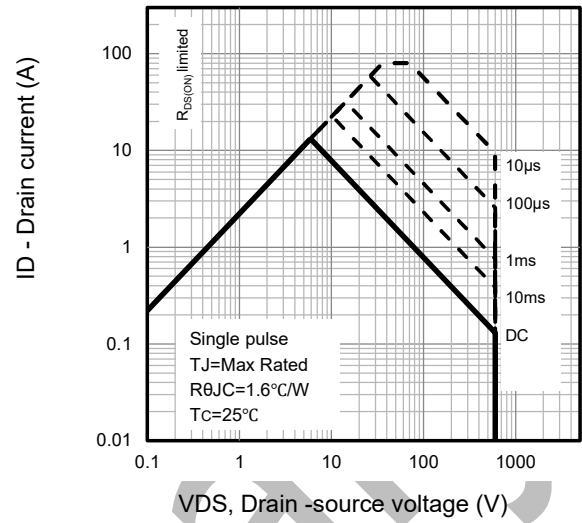


Fig8. Maximum safe operating area

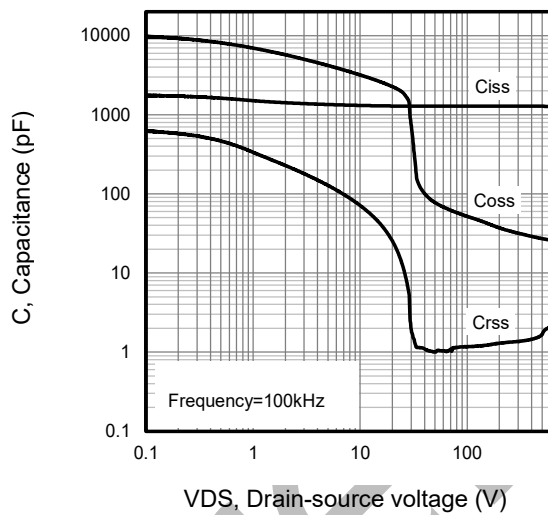


Fig9. Typical capacitance Vs. drain-source voltage

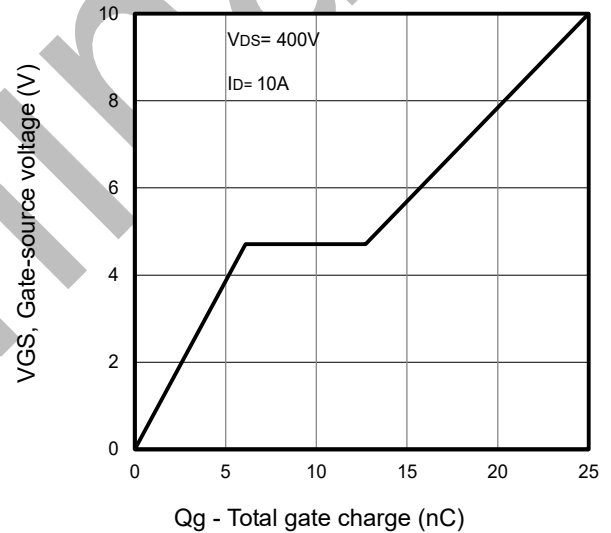


Fig10. Typical gate charge Vs. gate-source voltage

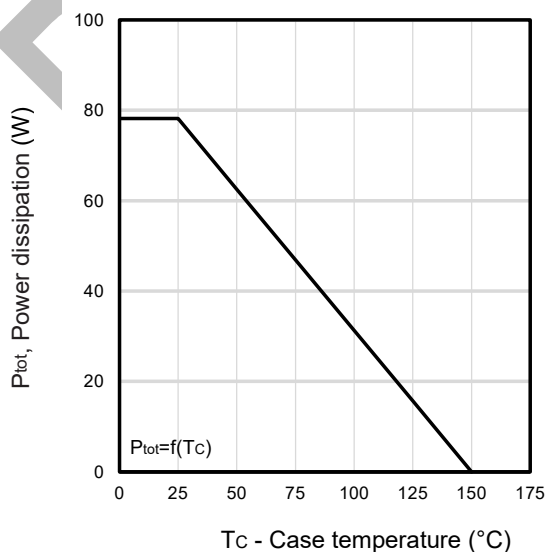


Fig11. Power dissipation Vs. case temperature

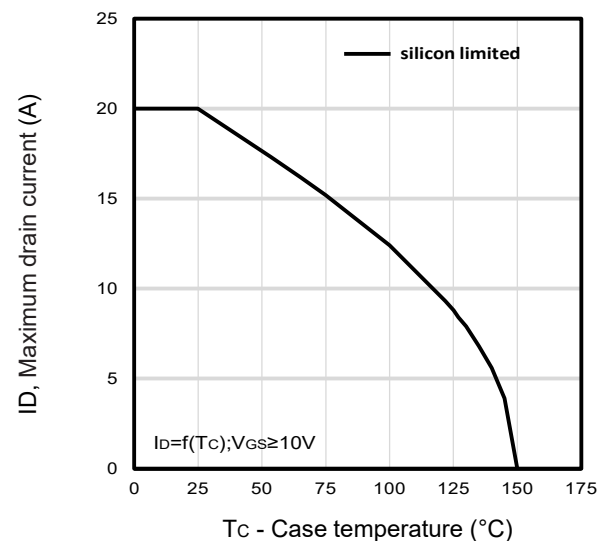


Fig12. Maximum drain current Vs. case temperature

Typical Characteristics

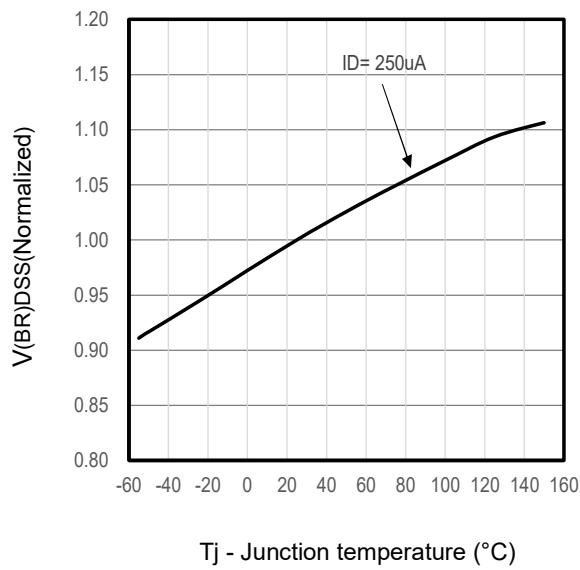


Fig13. Typical $V(BR)_{DSS}$ Vs T_j

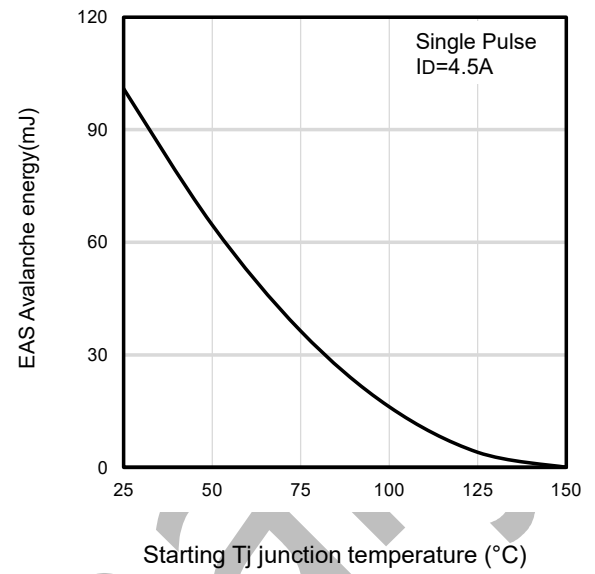


Fig14. Maximum avalanche energy vs temperature ($^{\circ}C$)

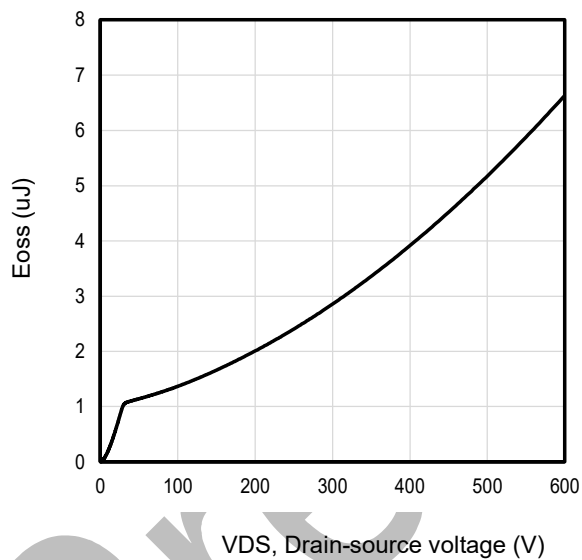


Fig15. Typical C_{oss} stored energy

Typical Characteristics

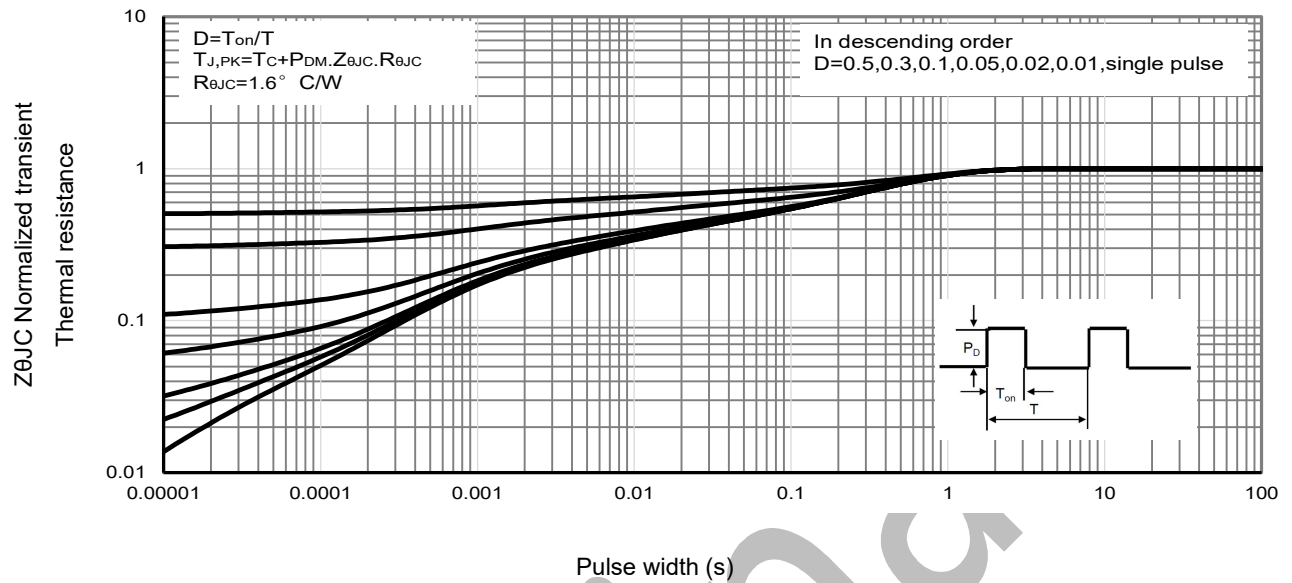


Fig16 . Normalized maximum transient thermal impedance

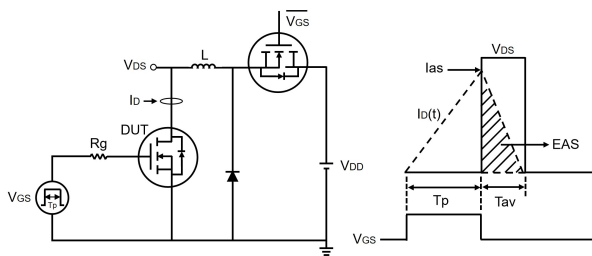


Fig17. Unclamped inductive test circuit and waveforms

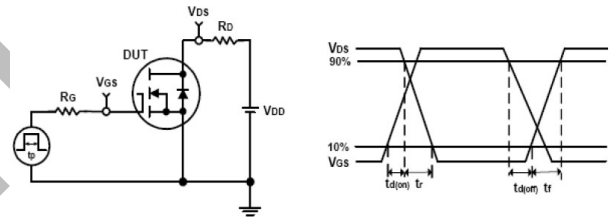
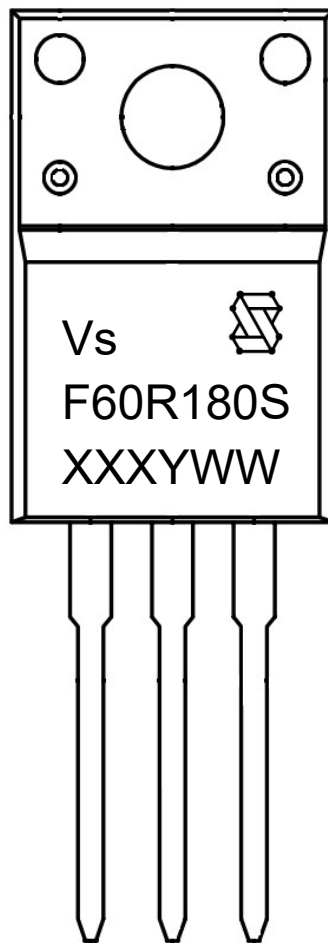


Fig18. Switching time test circuit and waveforms

Marking Information



1st line: Vergiga Code (Vs) , Vergiga Logo

2nd line: Part Number (F60R180S)

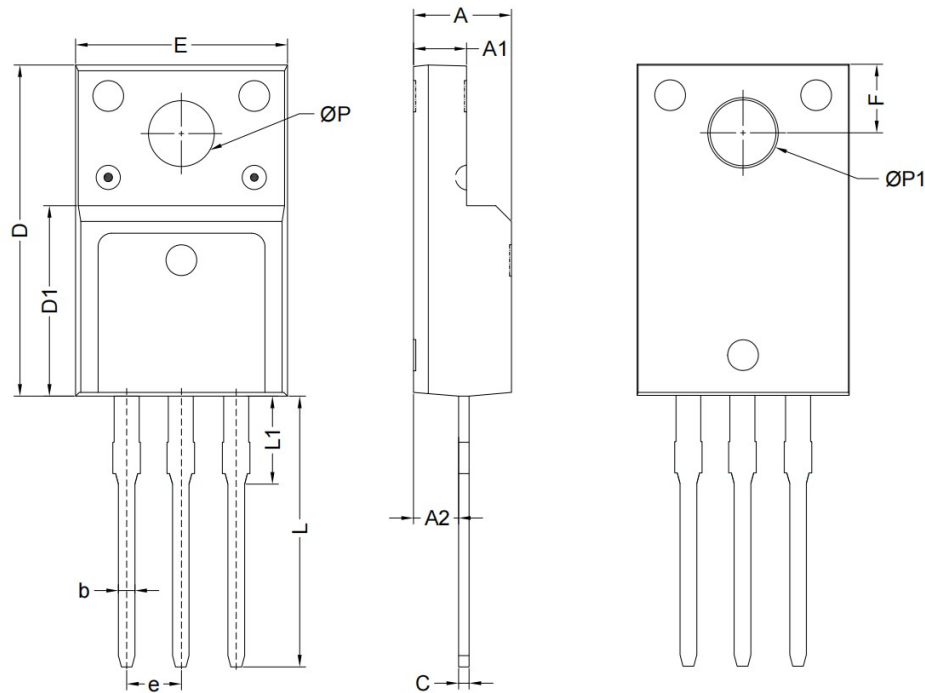
3rd line: Date code (XXXYWW)

XXX: Wafer Lot Number Code , code changed with Lot Number

Y: Year Code, refer to table below

WW: Week Code (01 to 53)

Code	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

TO-220F Package Outline Data


Symbol	Dimensions (unit: mm)		
	Min	Typ	Max
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	2.66	2.76	2.86
b	0.75	0.80	0.85
C	0.45	0.50	0.55
D	15.67	15.87	16.07
D1	9.04	9.12	9.20
e	2.50	2.54	2.58
E	10.00	10.16	10.30
F	3.20	3.30	3.40
L	12.78	12.98	13.18
L1	3.13	3.23	3.33
ØP	3.08	3.18	3.28
ØP1	3.30	3.40	3.50