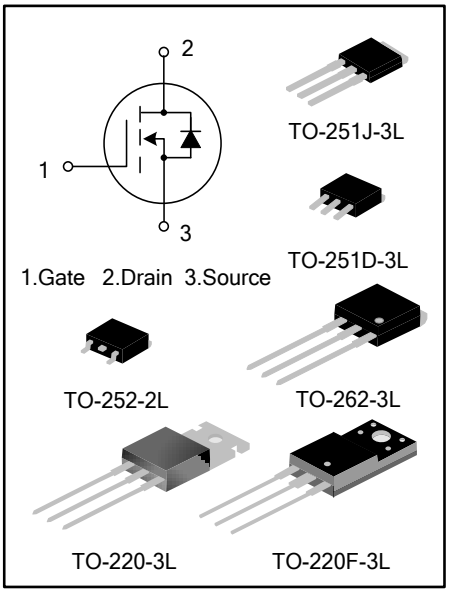
4A, 600V N-CHANNEL MOSFET

GENERAL DESCRIPTION

These N-Channel enhancement mode power field effect transistors are produced using Hi-semicon's proprietary, planar stripe, DMOS technology.

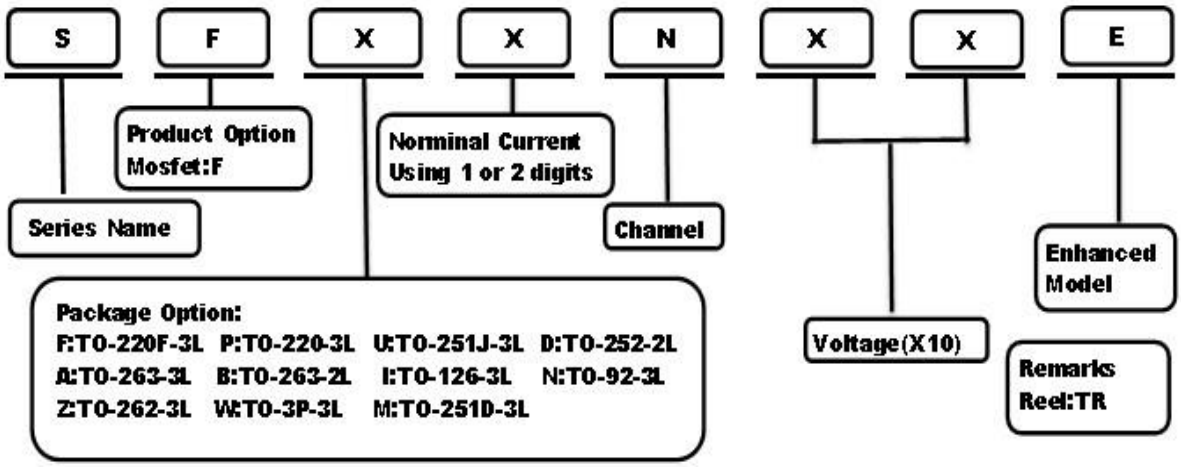
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology



FEATURES

- 4A, 600V, $R_{DS(on)(typ)}$=2.0Ω@V_{GS}=10V
- Low gate charge
- Low Crss
- Fast switching
- Improved dv/dt capability

NOMENCLATURE



ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SFF4N60E	TO-220F-3L	SFF4N60E	Pb free	Tube
SFZ4N60E	TO-262-3L	SFZ4N60E	Pb free	Tube
SFD4N60E	TO-252-2L	SFD4N60E	Pb free	Tape & Reel
SFU4N60E	TO-251J-3L	SFU4N60E	Pb free	Tube

ABSOLUTE MAXIMUM RATINGS (T_C=25°C unless otherwise noted；reference only)

Characteristics		Symbol	Ratings				Unit
			SFF4N60E	SFZ4N60E	SFD4N60E	SFU4N60E	
Drain-Source Voltage		V_{DS}	600				V
Gate-Source Voltage		V_{GS}	±30				V
Drain Current	T_C=25°C	I_D	4.0				A
	T_C=100°C		2.5				
Drain Current Pulsed		I_{DM}	16				A
Power Dissipation(T_C=25°C)		P_D	33	92	77	86	W
-Derate above 25°C			0.26	0.74	0.62	0.69	W/°C
Single Pulsed Avalanche Energy(Note 1)		E_{AS}	217				mJ
Operation Junction Temperature Range		T_J	-55～+150				°C
Storage Temperature Range		T_{stg}	-55～+150				°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	Ratings				Unit
		SFF4N60E	SFZ4N60E	SFD4N60E	SFU4N60E	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	3.85	1.36	1.61	1.45	°C/W
ThermalResistance,Junction-to-Ambient	$R_{\theta JA}$	120	62.5	110	110	°C/W

ELECTRICAL CHARACTERISTICS (T_C=25°C unless otherwise noted, reference only)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Drain -Source Breakdown Voltage	B_{VDSS}	V_{GS}=0V, I_D=250μA	600	--	--	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V	--	--	1.0	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS}= V_{DS}, I_D=250μA	2.0	--	4.0	V
Static Drain- Source On State Resistance	$R_{DS(on)}$	V_{GS}=10V, I_D=2A	--	2.0	2.4	Ω
Input Capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V, f=1.0MHZ	312	405	527	pF
Output Capacitance	C_{oss}		--	55	--	
Reverse Transfer Capacitance	C_{rss}		--	5.6	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=300V,I_D=4A, R_G=25Ω (Note2,3)	--	11.9	--	ns
Turn-on Rise Time	t_r		--	21.6	--	
Turn-off Delay Time	$t_{d(off)}$		--	39.7	--	
Turn-off Fall Time	t_f		--	23.8	--	
Total Gate Charge	Q_g	V_{DS}=480V,I_D=4A, V_{GS}=10V (Note 2,3)	--	12.7	--	nC
Gate-Source Charge	Q_{gs}		--	2.68	--	
Gate-Drain Charge	Q_{gd}		--	6.63	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	4.0	A
Pulsed Source Current	I_{SM}		--	--	16	
Diode Forward Voltage	V_{SD}	I_S=4.0A,V_{GS}=0V	--	--	1.4	V
Reverse Recovery Time	T_{rr}	I_S=4.0A,V_{GS}=0V, dI_F/dt=100A/μs (Note 2)	--	420	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.75	--	μC

Notes:

1. L=30mH, I_{AS}=3.75A, V_{DD}=100V, R_G=25Ω, starting T_J=25°C;
2. Pulse Test: Pulse width ≤300μs,Duty cycle≤2%;
3. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

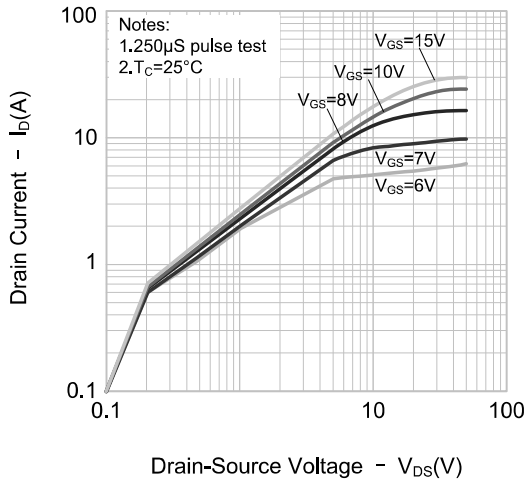


Figure 2. Transfer Characteristics

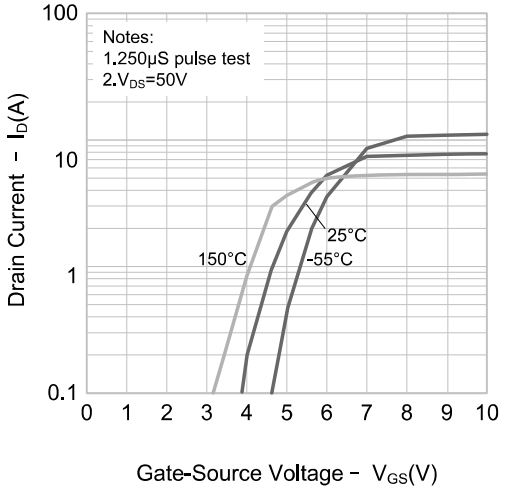


Figure 3. On-Resitance Variation vs. Drain Current and Gate Voltage

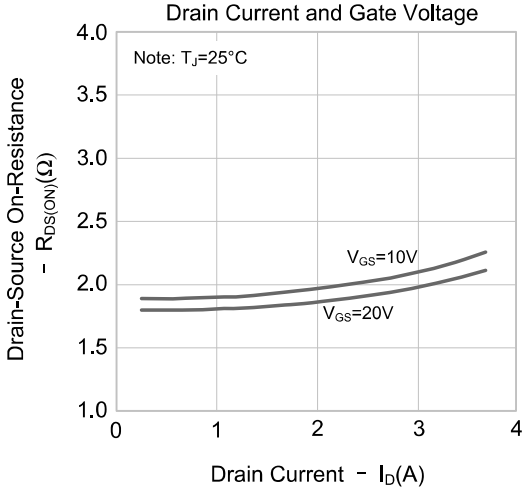
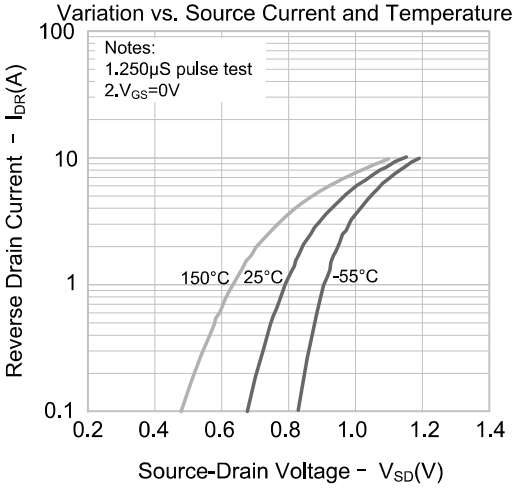


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature



TYPICAL CHARACTERISTICS(continued)

Figure 5. Capacitance Characteristics

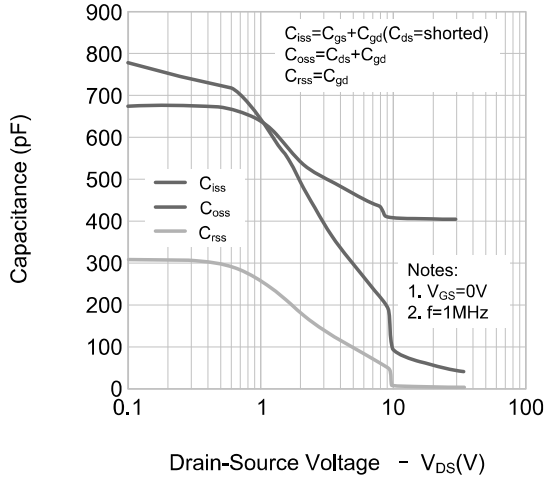


Figure 6. Gate Charge Characteristics

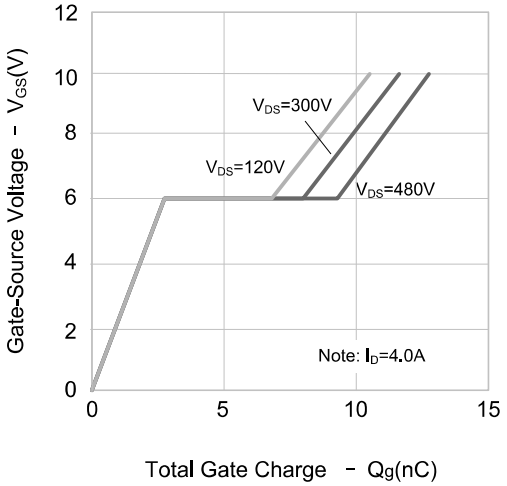


Figure 7. Breakdown Voltage Variation vs. Temperature

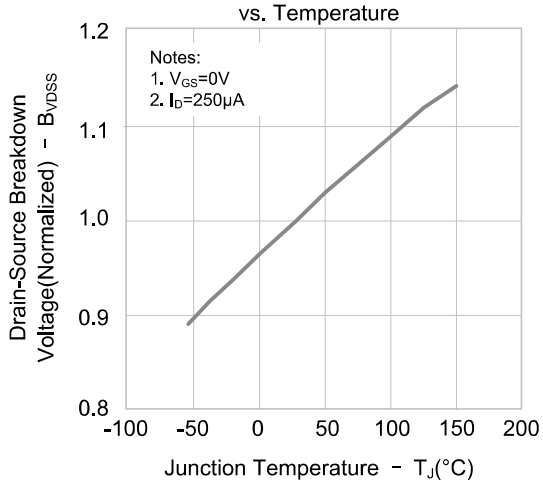


Figure 8. On-resistance Variation vs. Temperature

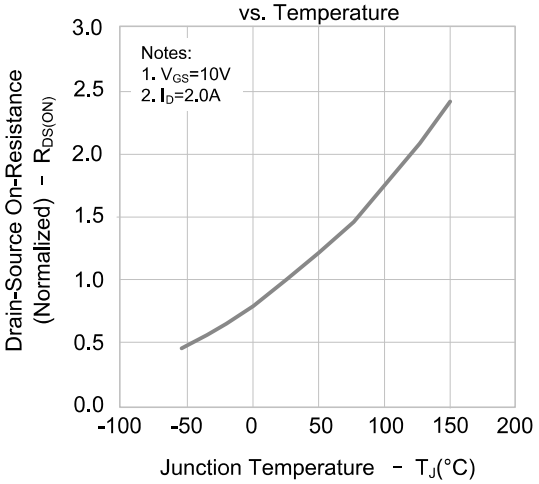


Figure 9-1. Max. Safe Operating Area(SFF4N60E)

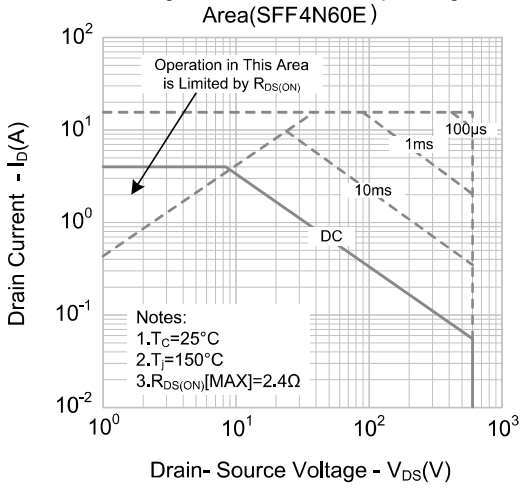
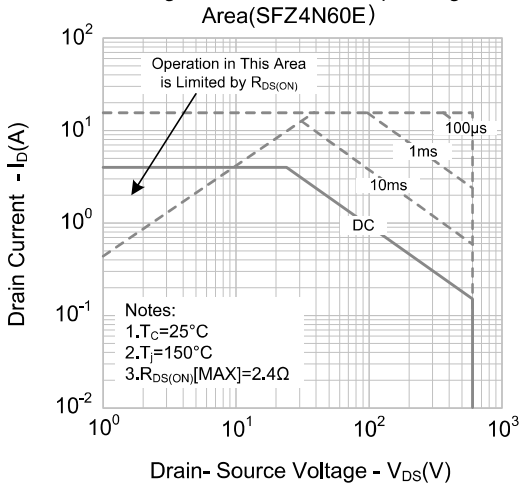


Figure 9-2. Max. Safe Operating Area(SFZ4N60E)



TYPICAL CHARACTERISTICS(continued)

Figure 9-3. Max. Safe Operating Area(SFD4N60E)

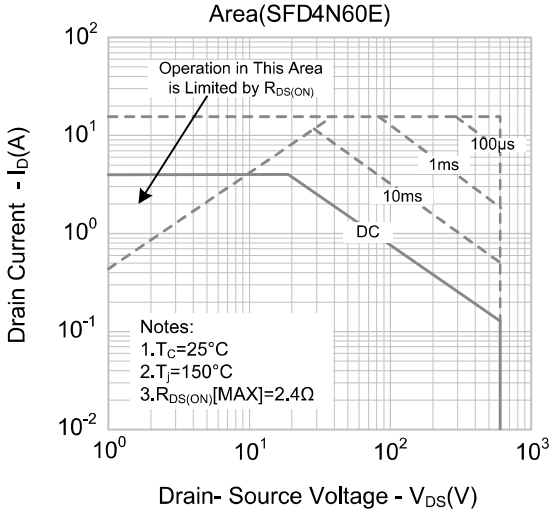


Figure 9-4. Max. Safe Operating Area(SFU4N60E)

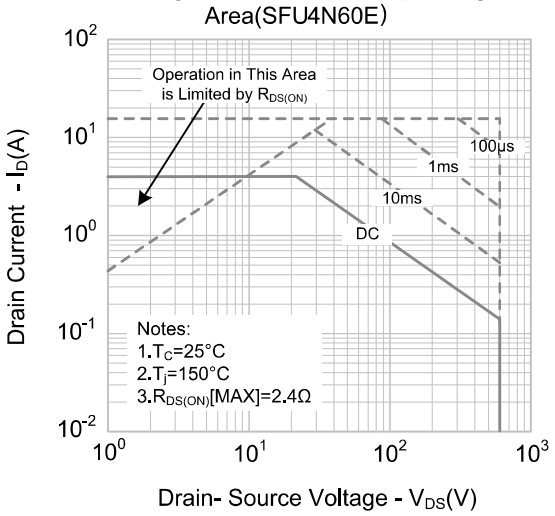
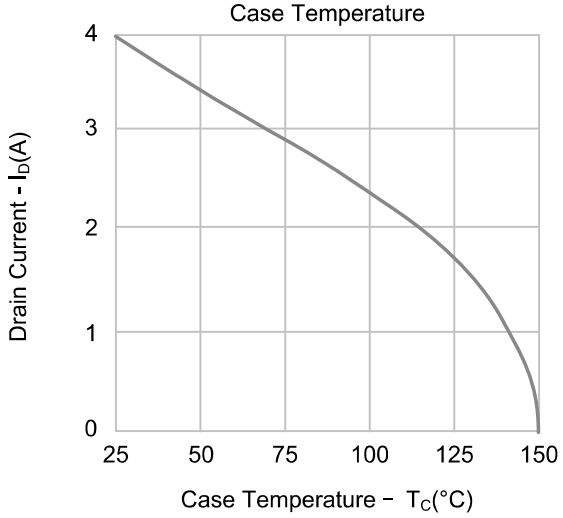
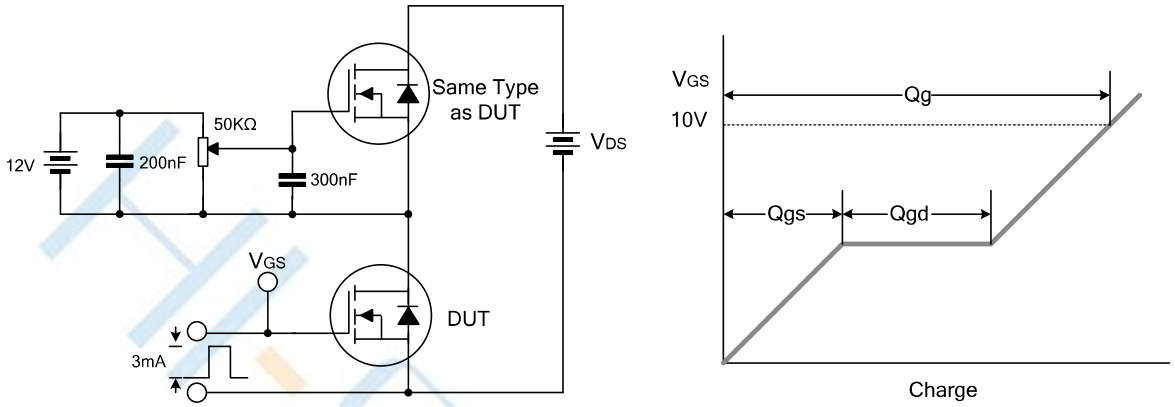


Figure 10. Maximum Drain Current vs. Case Temperature

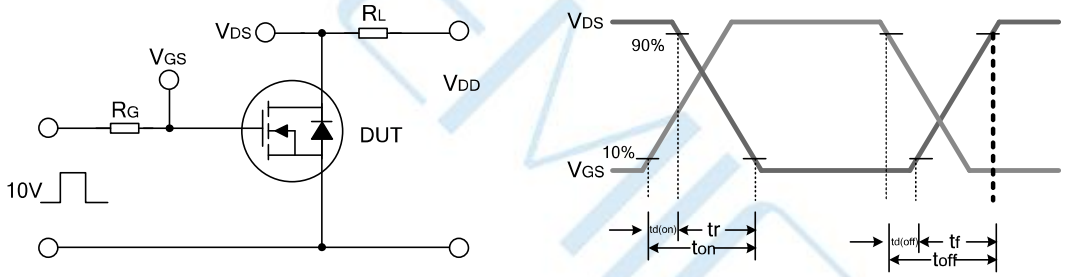


TYPICAL TEST CIRCUIT

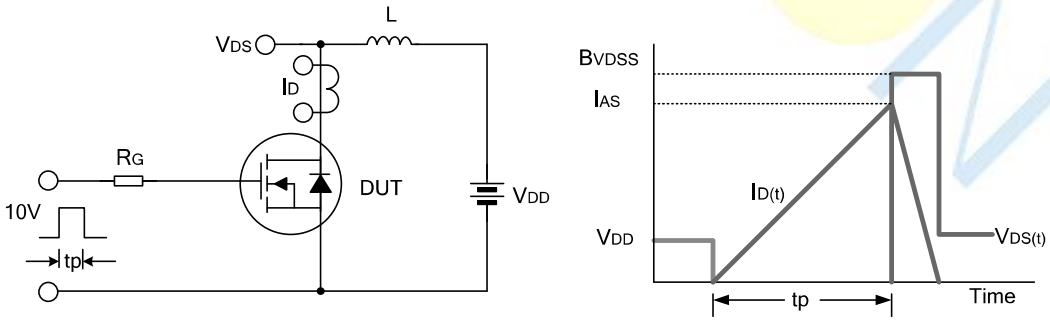
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

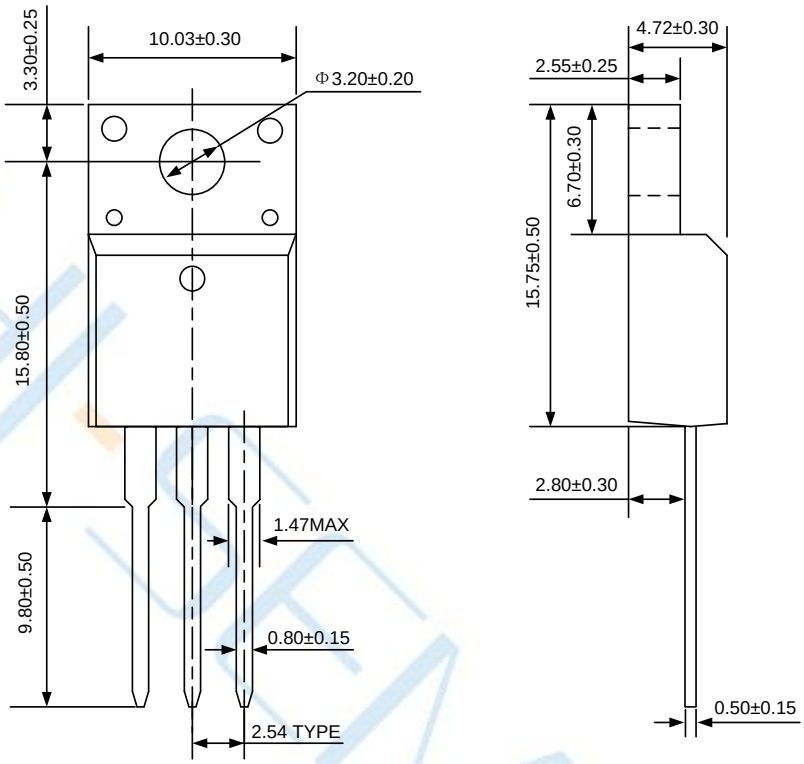


Unclamped Inductive Switching Test Circuit & Waveform

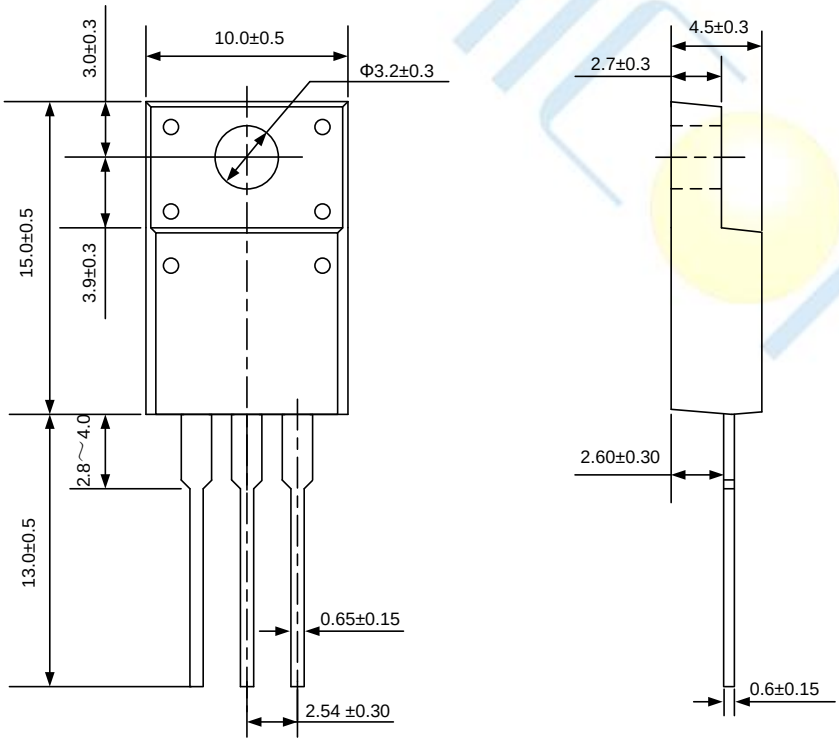


PACKAGE OUTLINE

TO-220F-3L(1) **UNIT: mm**

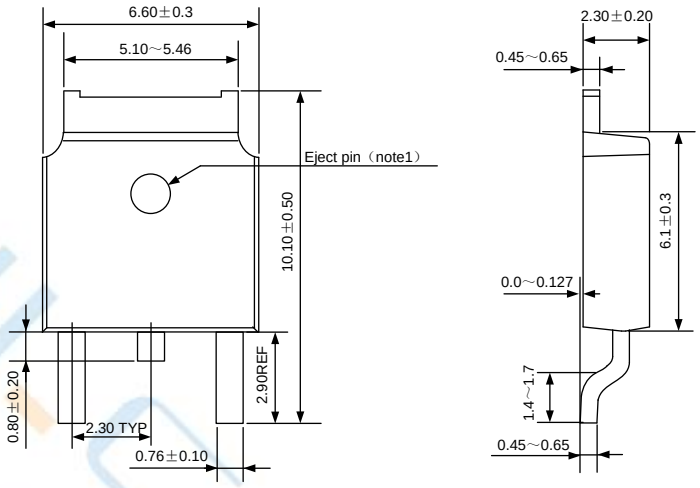


TO-220F-3L(2) **UNIT: mm**



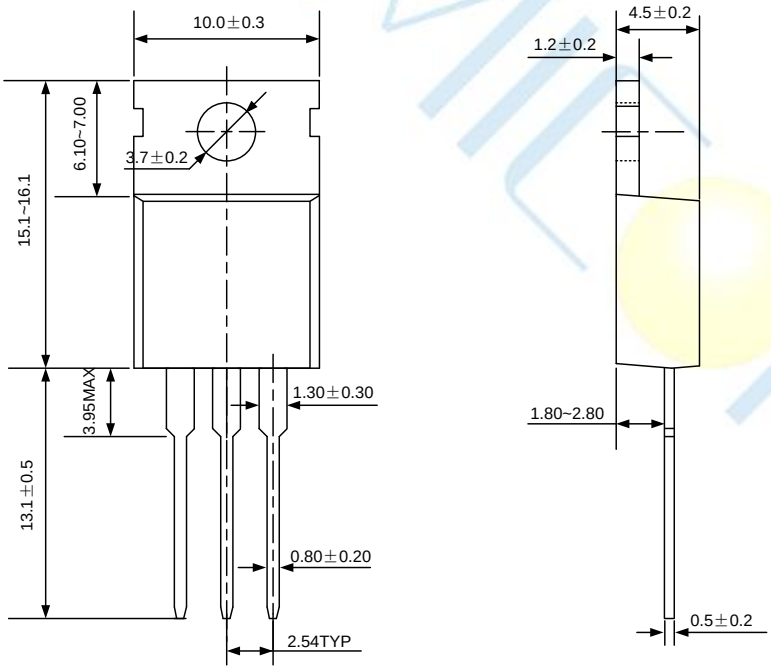
PACKAGE OUTLINE (continued)

TO-252-2L **UNIT: mm**



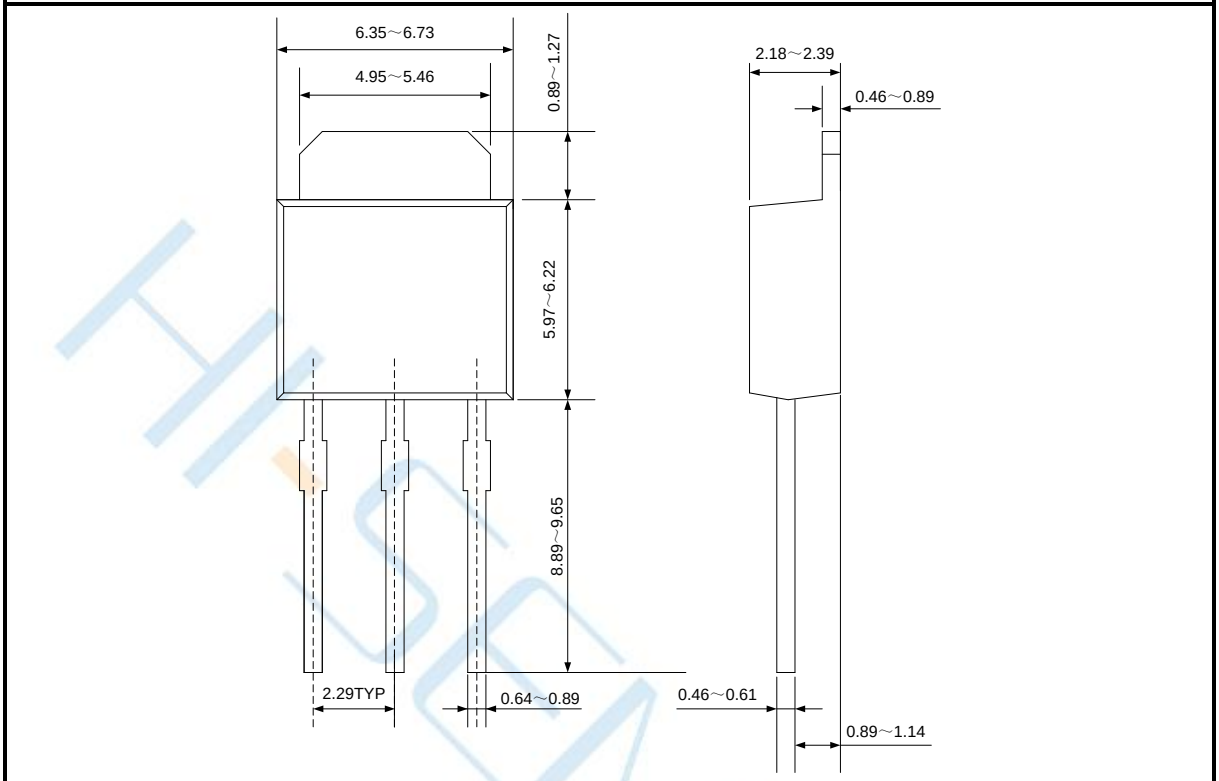
NOTE1 There are two conditions for this position:has an eject pin or has no eject pin.

TO-220-3L **UNIT: mm**

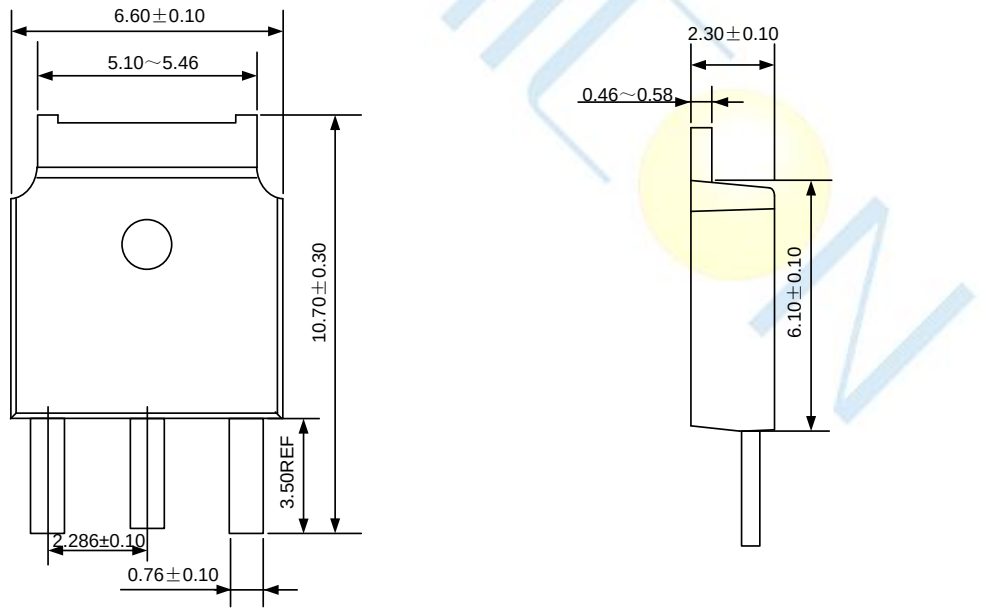


PACKAGE OUTLINE (continued)

TO-251J-3L **UNIT: mm**



TO-251D-3L **UNIT: mm**



PACKAGE OUTLINE (continued)

TO-262-3L **UNIT: mm**