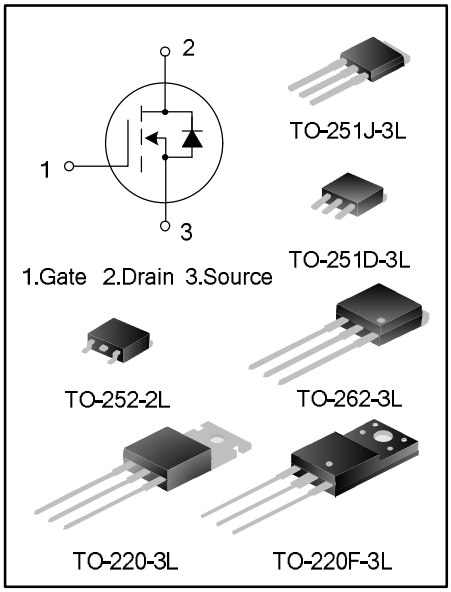
4A, 600V N-CHANNEL MOSFET

GENERAL DESCRIPTION

This power mosfet is an N-channel enhancement mode power MOS field effect transistor which is produced using Hi-semicon proprietary F-Cell™ structure VDMOS technology. The improved planar stripe cell and the improved guard ring terminal have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

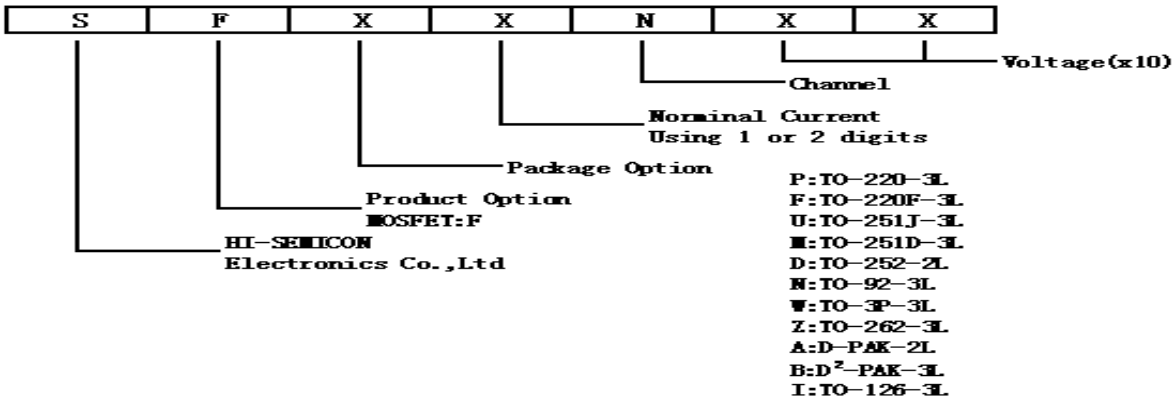
These devices are widely used in AC-DC power suppliers, DC-DC converters and H-bridge PWM motor drivers.



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
SFP4N60	TO-220-3L	SFF4N60	Pb free	Tube
SFF4N60	TO-220F-3L	SFF4N60	Pb free	Tube
SFZ4N60	TO-262-3L	SFZ4N60	Pb free	Tube
SFD4N60	TO-252-2L	SFD4N60	Pb free	Tape & Reel
SFU4N60	TO-251J-3L	SFU4N60	Pb free	Tube
SFM4N60	TO-251D-3L	SFM4N60	Pb free	Tube

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

Characteristics		Symbol	Ratings					Unit
			SFP4N60	SFF4N60	SFD/M4N60	SFU4N60	SFZ4N60	
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	100	33	77	86	95	W
-Derate above 25°C			0.8	0.26	0.62	0.69	0.76	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
		SFP4N60	SFF4N60	SFD/M4N60	SFU4N60	SFZ4N60	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	3.85	1.61	1.45	1.32	°C/W
ThermalResistance,Junction-to-Ambient	$R_{\theta JA}$	62.5	120	110	110	62.5	°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	--	449.7	--	pF
Output Capacitance	C_{oss}		--	57	--	
Reverse Transfer Capacitance	C_{rss}		--	2.0	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=300V,I_D=4A, R_G=25Ω (Note2,3)	--	15.7	--	ns
Turn-on Rise Time	t_r		--	37.3	--	
Turn-off Delay Time	$t_{d(off)}$		--	19.1	--	
Turn-off Fall Time	t_f		--	19.3	--	
Total Gate Charge	Q_g	V_{DS}=480V,I_D=4A, V_{GS}=10V (Note 2,3)	--	8.16	--	nC
Gate-Source Charge	Q_{gs}		--	2.63	--	
Gate-Drain Charge	Q_{gd}		--	3.01	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N	--	--	4.0	A
Pulsed Source Current	I_{SM}	Junction Diode in the MOSFET	--	--	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,	--	441.53	--	ns
Reverse Recovery Charge	Q_{rr}	dI_F/dt=100A/μs (Note 2)	--	1.98	--	μC

Notes:

1. L=30mH, I_{AS}=3.45A, V_{DD}=155V, R_G=25Ω, starting TB_{JB}=25°C;
2. Pulse Test: Pulse width ≤300μs,Duty cycle≤2%;
3. Essentially independent of operating temperature.

TYPICAL CHARACTERISTICS

Figure 1. On-Region Characteristics

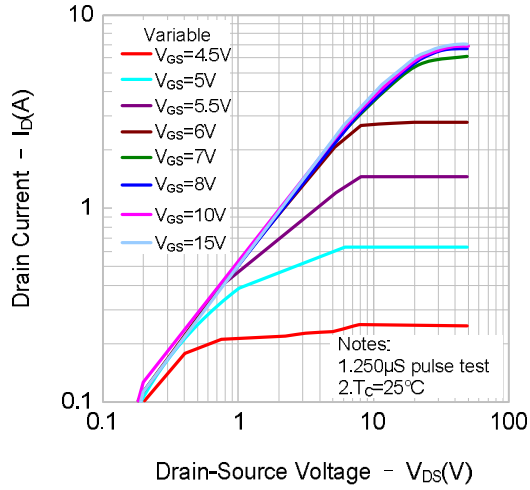


Figure 2. Transfer Characteristics

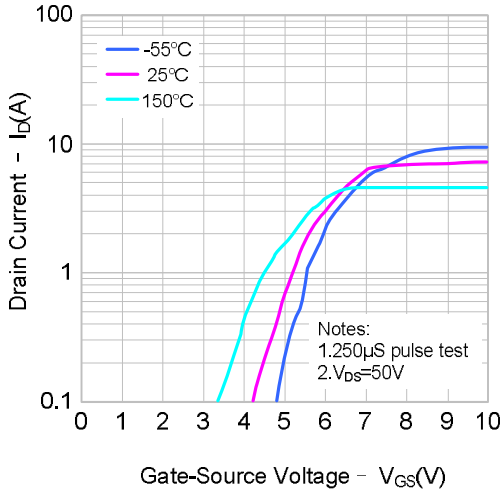


Figure 3. On-Resitance Variation vs. Drain Current and Gate Voltage

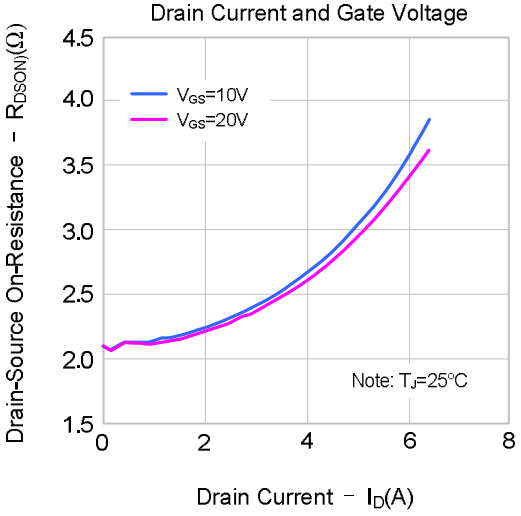
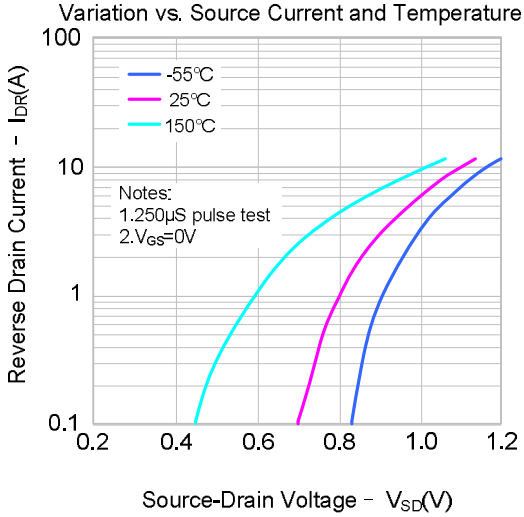


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature



TYPICAL CHARACTERISTICS(continued)

Figure 5. Capacitance Characteristics

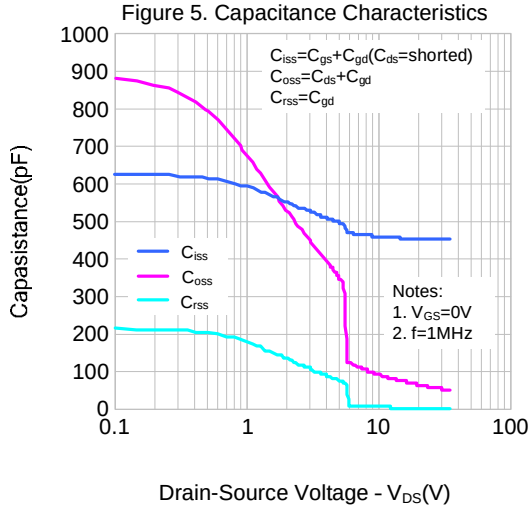


Figure 6. Gate Charge Characteristics

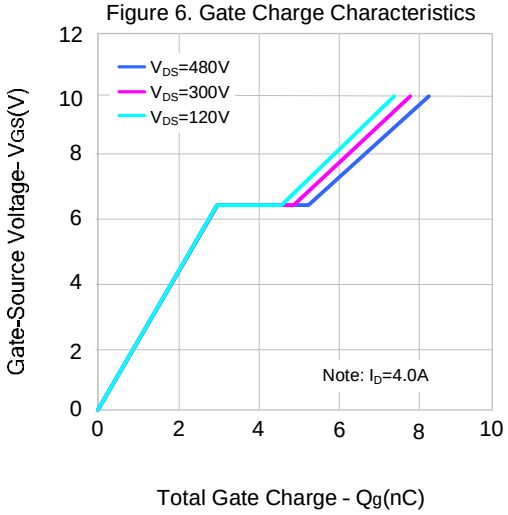


Figure 7. Breakdown Voltage Variation vs. Temperature

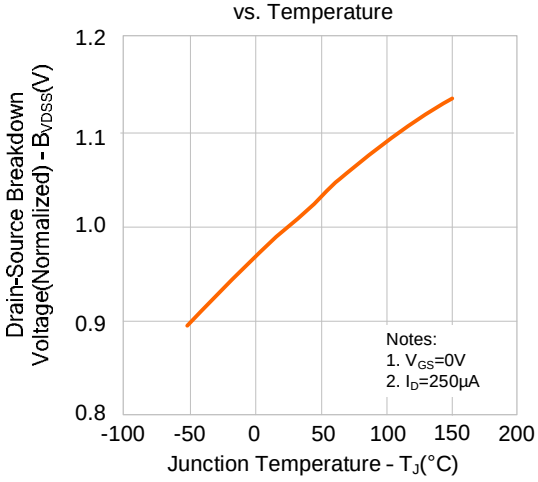


Figure 8. On-resistance Variation vs. Temperature

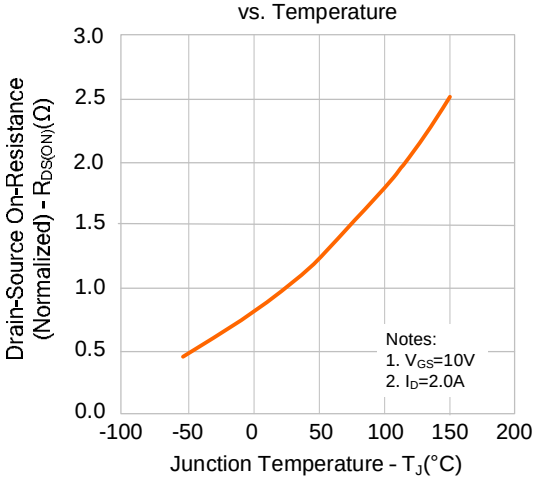


Figure 9-1. Max. Safe Operating Area (SFP4N60)

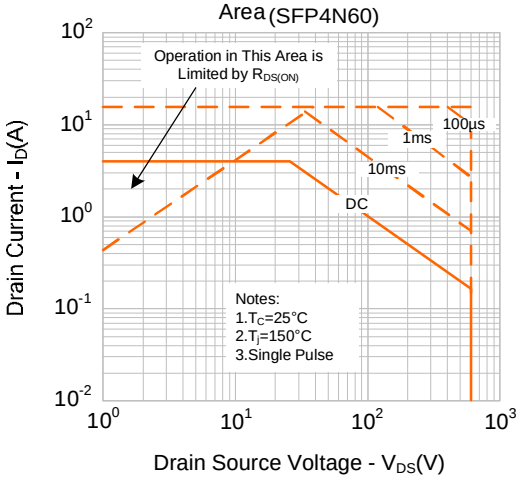
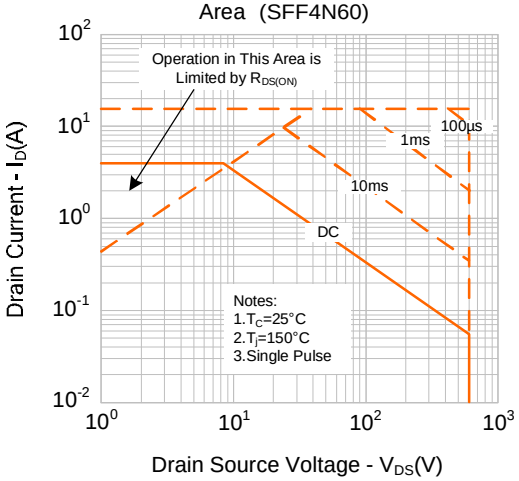


Figure 9-2. Max. Safe Operating Area (SFF4N60)



TYPICAL CHARACTERISTICS (continued)

Figure 9-3. Max. Safe Operating Area (SFD/M4N60)

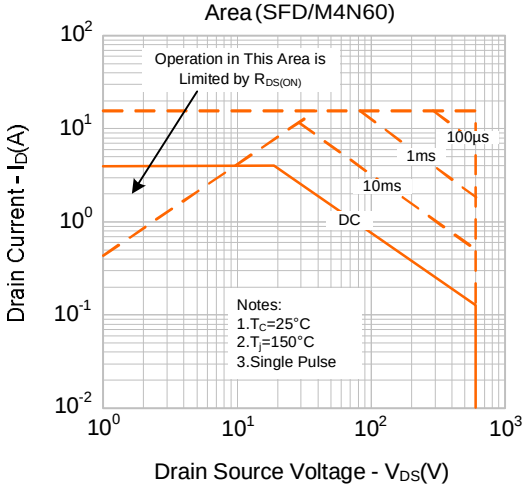


Figure 9-4. Max. Safe Operating Area (SFU4N60)

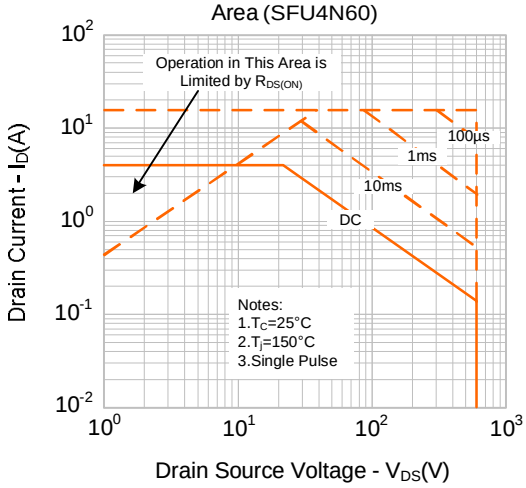


Figure 9-5. Max. Safe Operating Area (SFZ4N60)

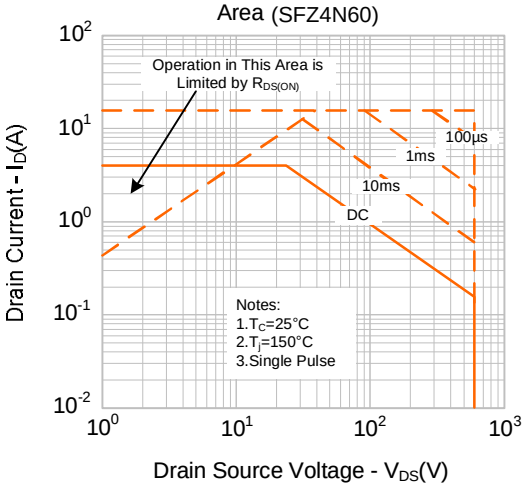
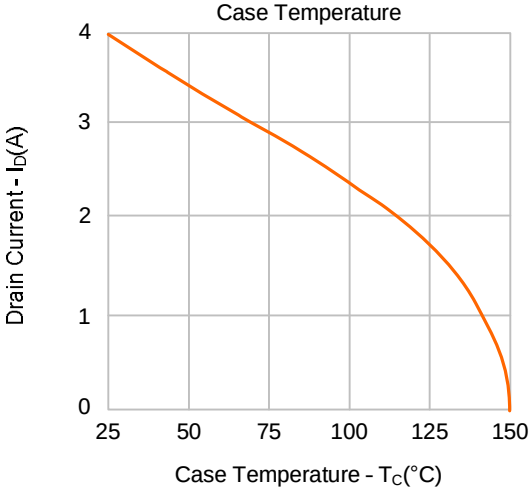
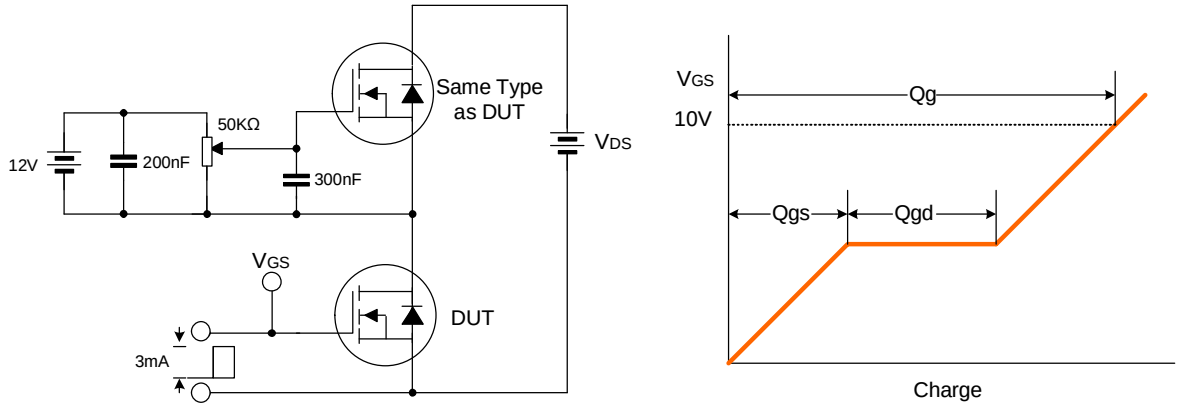


Figure 10. Maximum Drain Current vs. Case Temperature

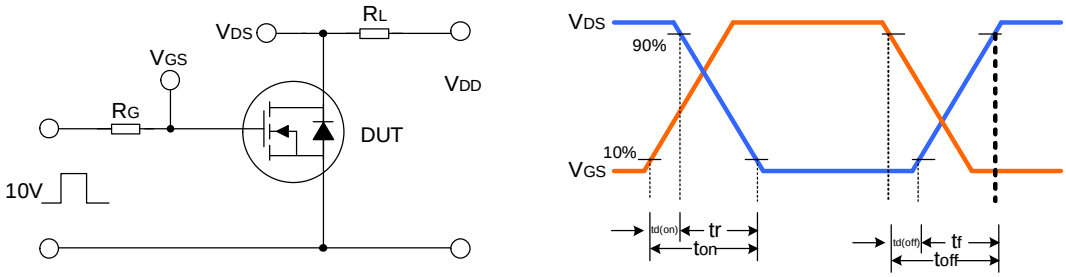


TYPICAL TEST CIRCUIT

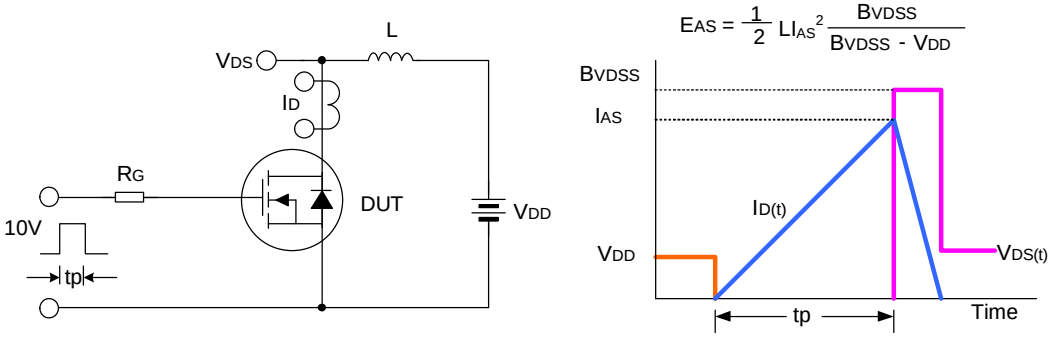
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

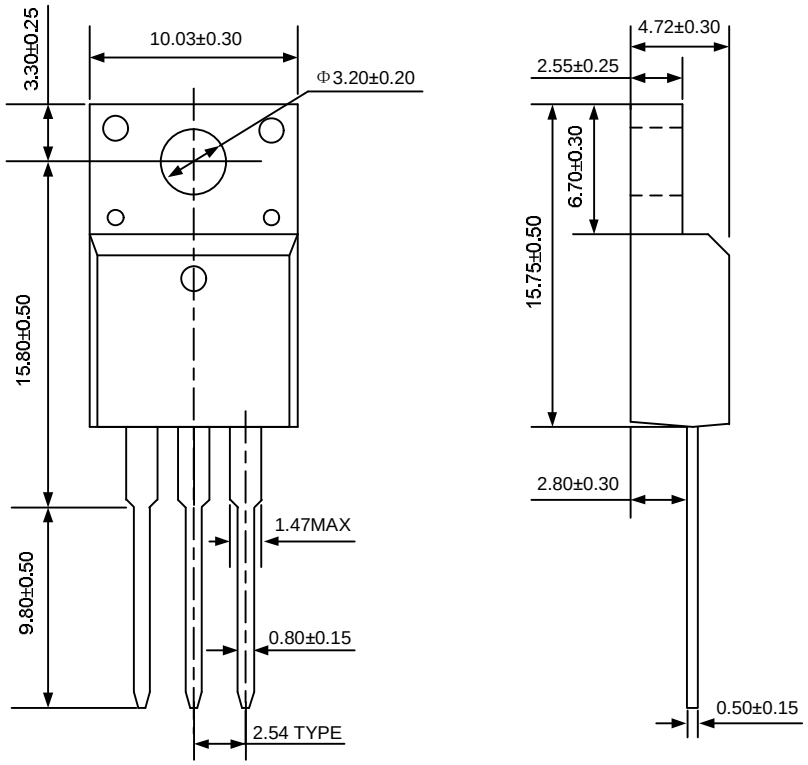


Unclamped Inductive Switching Test Circuit & Waveform

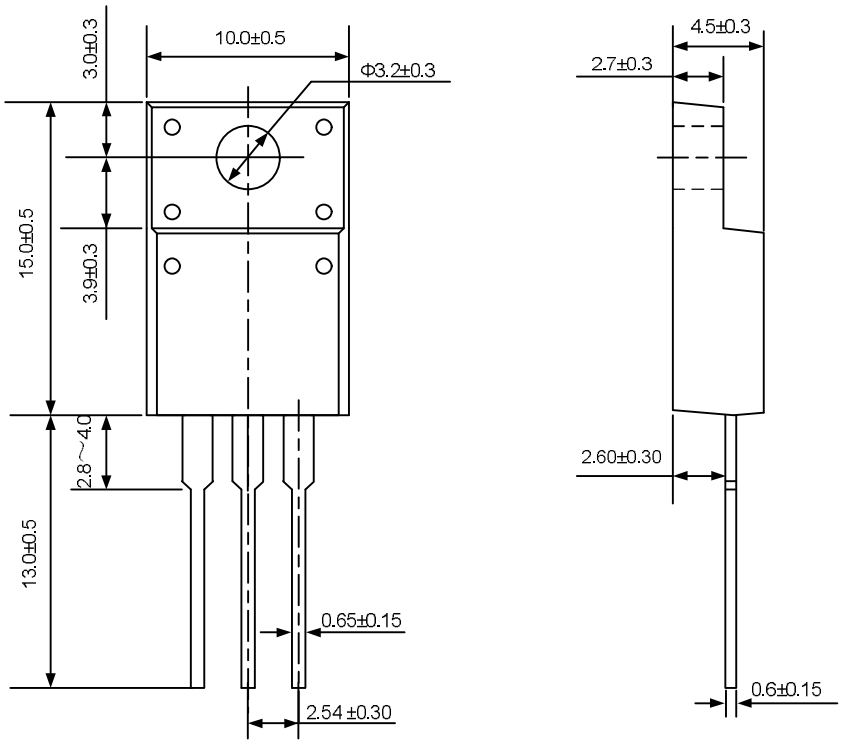


PACKAGE OUTLINE

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

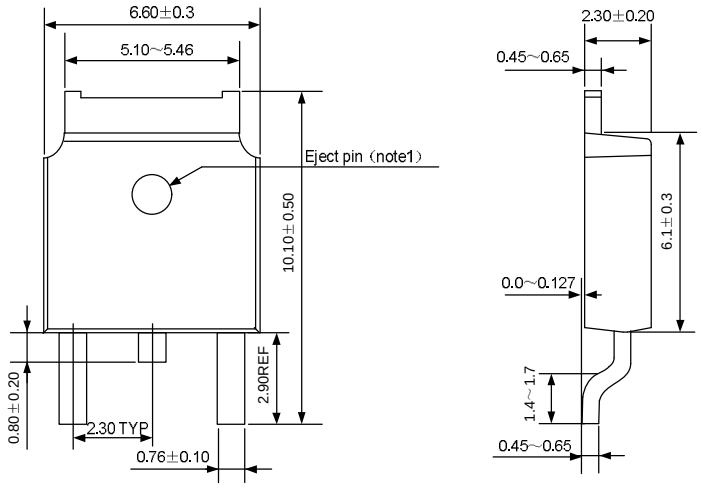


TO-220F-3L(2) UNIT: mm



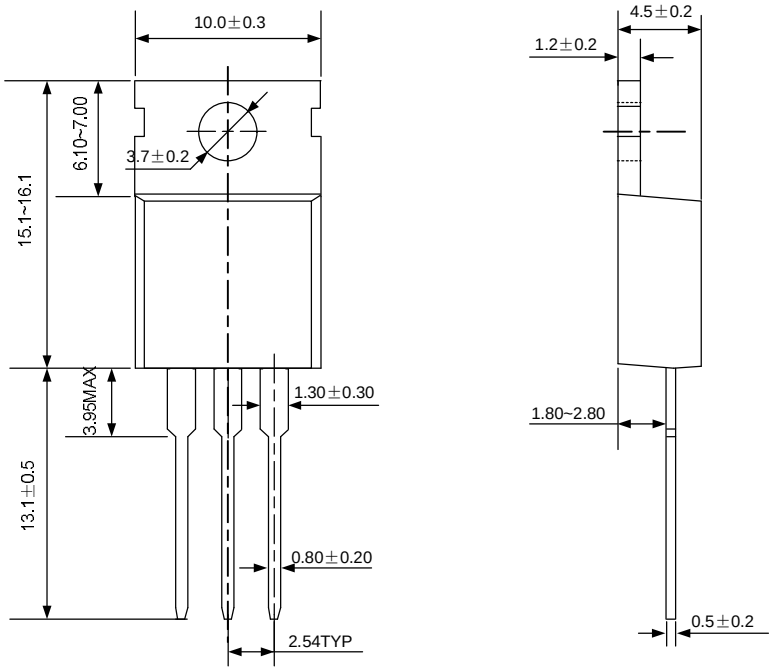
PACKAGE OUTLINE (continued)

TO-252-2L UNIT: mm



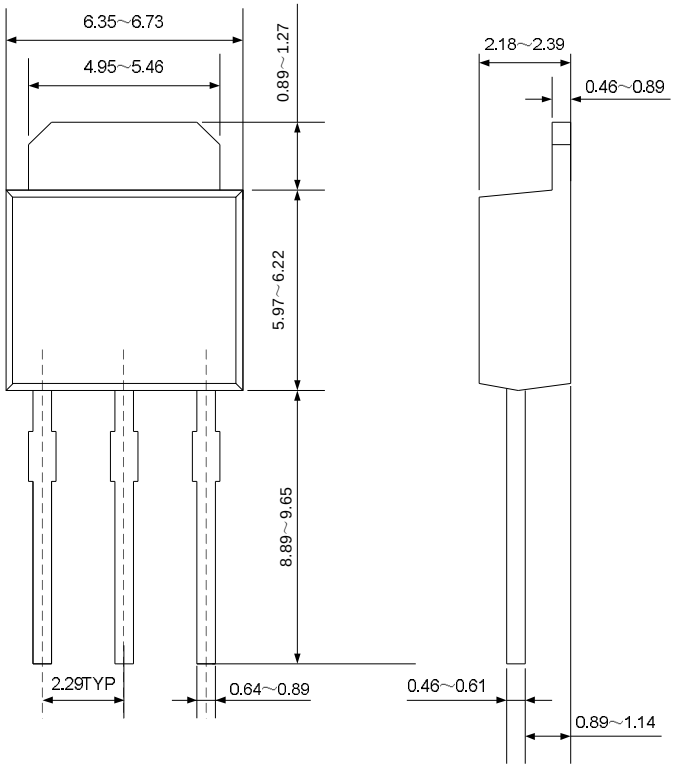
NOTE1‖ There are two conditions for this position:has an eject pin or has no eject pin.

TO-220-3L UNIT: mm

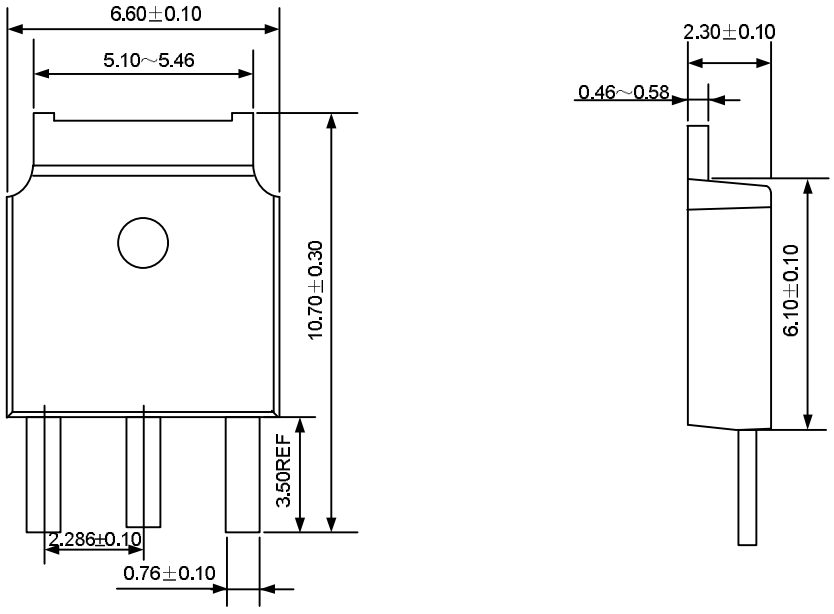


PACKAGE OUTLINE (continued)

TO-251J-3L UNIT: mm

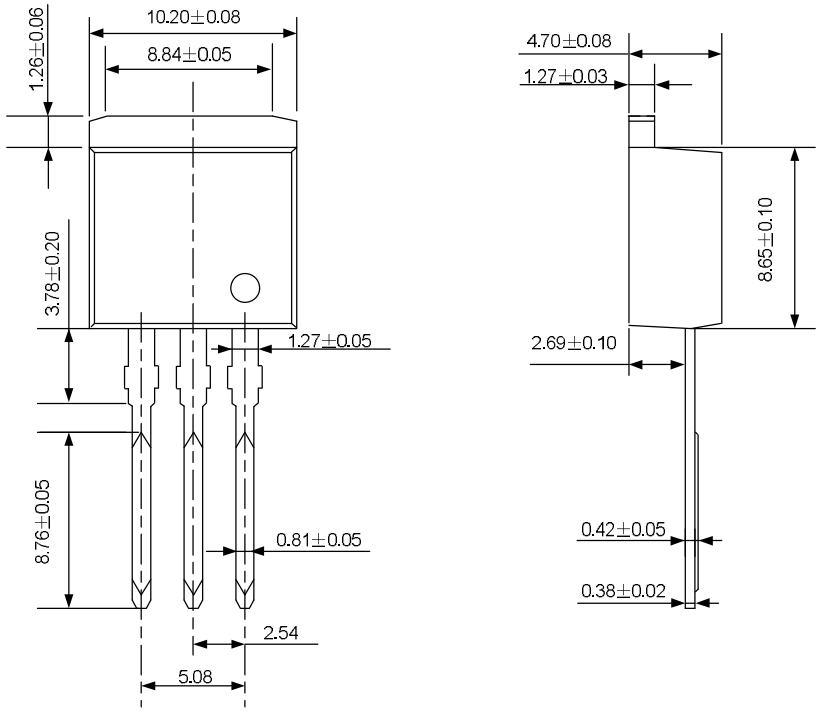


TO-251D-3L UNIT: mm



PACKAGE OUTLINE (continued)

TO-262-3L UNIT: mm



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