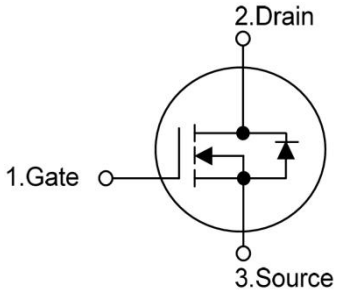
13A, 650V N-CHANNEL POWER MOSFET

■ DESCRIPTION

The 13N65 are N-Channel enhancement mode power field effect transistors (MOSFET) which are produced by using our proprietary, planar stripe and DMOS technology.

These devices are suited for high efficiency switch mode power supply. To minimize on-state resistance, provide superior switching performance and withstand high energy pulse in the avalanche and commutation mode, the advanced technology has been especially tailored.



■ FEATURES

* $R_{DS(ON)} \leq 0.88\ \Omega$ @ V_{GS} = 10V, I_D = 1.0A
* Ultra low gate charge (typical 42 nC)
* Low reverse transfer capacitance (CRSS = typical 15 pF)
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ ABSOLUTE MAXIMUM RATINGS(TA=25°C, unless otherwise specified.)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 2)		I_{AR}	12	A
Continuous Drain Current		I_D	12	A
Pulsed Drain Current (Note 2)		I_{DM}	24	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	75	mJ
	Repetitive (Note 2)	E_{AR}	24	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation		P_D	51	W
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C
Operating Temperature		T_{OPR}	-55 ~ +150	°C

Notes: 1.Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2.Repetitive Rating: Pulse width limited by maximum junction temperature.

3.L = 5mH, I_{AS} = 5.5A, V_{DD}= 50V, R_G=25Ω , Starting TJ = 25°C

4.I_{SD} ≤ 12A, di/dt ≤ 200A/μs, V_{DD}≤ BV_{DSS} , Starting TJ = 25°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θJA	62.5	°C/W
Junction to Case	θJC	2.45	°C/W

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

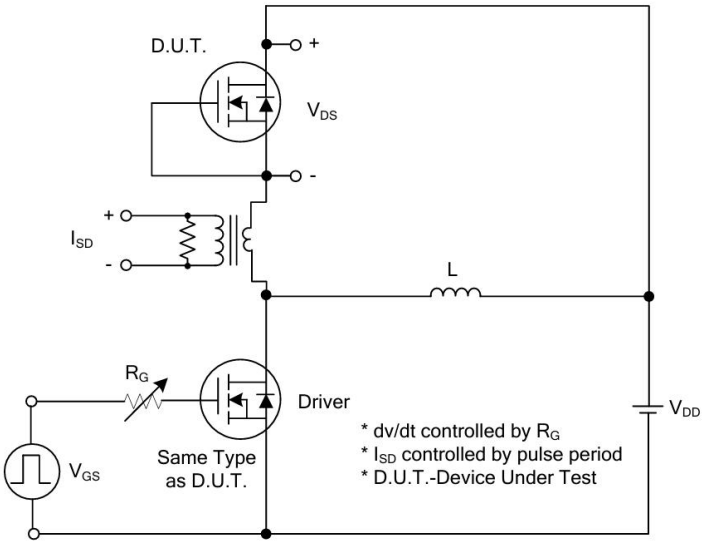
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	650			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=650V, V_{GS}=0V			1	μA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V			±100	nA
Breakdown Voltage Temperature Coefficient	△BV_{DSS}/△TJ	I_D=250μA,Referenced to 25°C		0.7		V/°C
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS} , I_D=250μA	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=1.0A		0.6	0.88	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	V_{DS}=25V,V_{GS}=0V f= 1.0MHz		2190	2600	pF
Output Capacitance	C_{OSS}			160	270	pF
Reverse Transfer Capacitance	C_{RSS}			7	15	pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q_G	V_{DS}=520V, V_{GS}= 10V I_D=12A (Note 1, 2)		42	54	nC
Gate-Source Charge	Q_{GS}			8.6		nC
Gate-Drain Charge	Q_{GD}			21		nC
Turn-On Delay Time	$t_{D(ON)}$	V_{DD}= 325V,I_D=12A, R_G=25Ω (Note 1, 2)		30	70	ns
Turn-On Rise Time	t_R			115	240	ns
Turn-Off Delay Time	$t_{D(OFF)}$			95	200	ns
Turn-Off Fall Time	t_F			85	180	ns

SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS

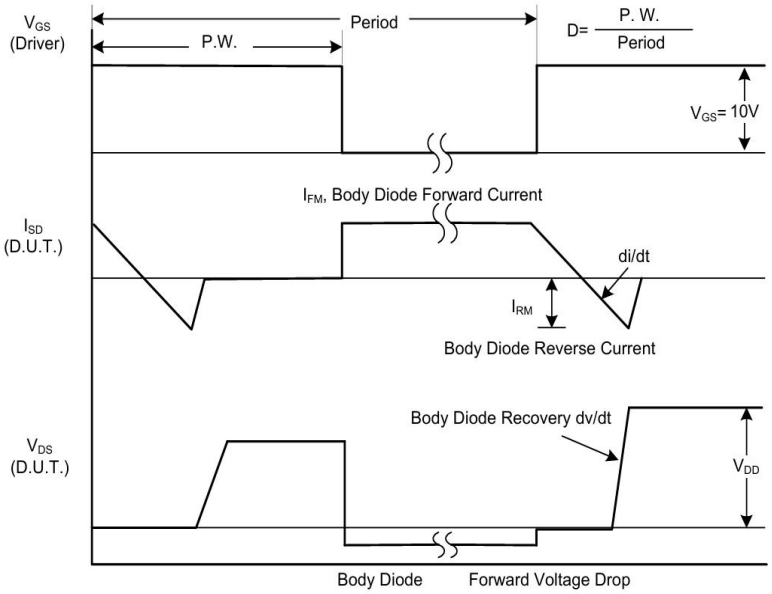
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Maximum Continuous Drain-Source Diode Forward Current	IS				12	A
Maximum Pulsed Drain-Source Diode Forward Current	ISM				15	A
Drain-Source Diode Forward Voltage	VSD	IS=5A , VGS=0V			1	V
Reverse Recovery Time	trr	IS=12A,VGS=0V,di/dt=100A/μs (Note 1, 2)		380		ns
Reverse Recovery Charge	Qrr			3.5		μC

Note: 1.Pulse test: pulse width ≤ 300us, duty cycle ≤ 2%； 2.Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

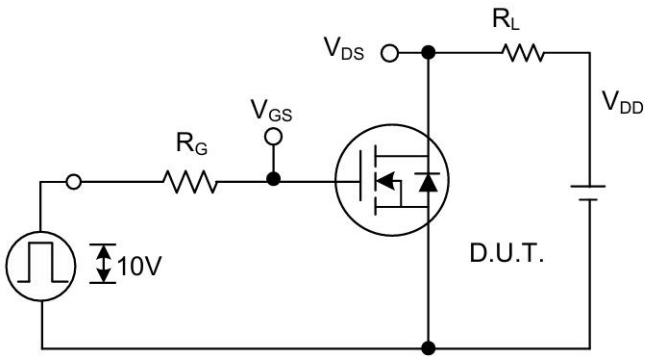


Peak Diode Recovery dv/dt Test Circuit

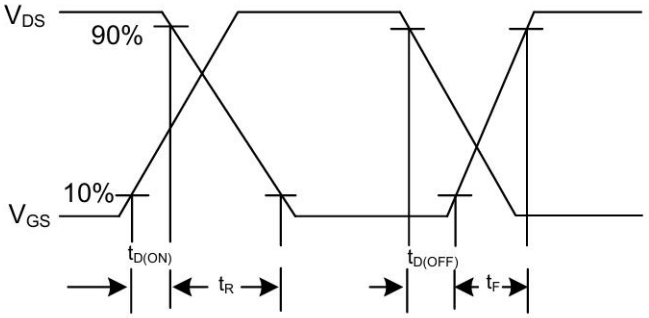


Peak Diode Recovery dv/dt Waveforms

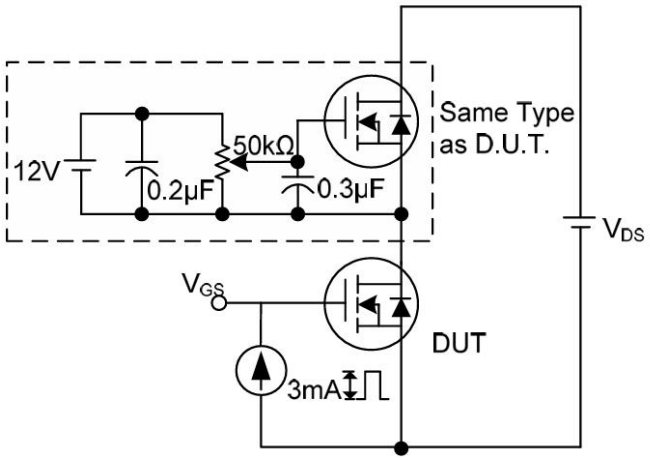
■ TEST CIRCUITS AND WAVEFORMS(Con.t)



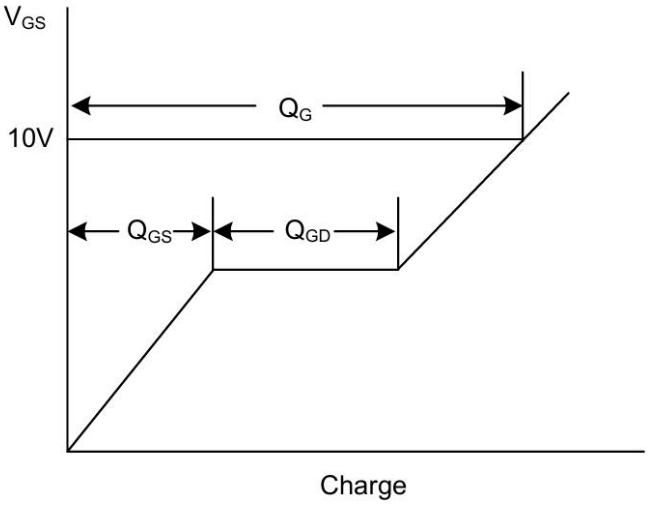
Switching Test Circuit



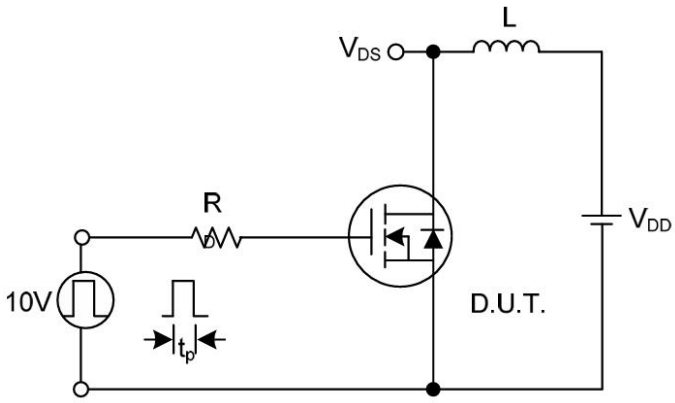
Switching Waveforms



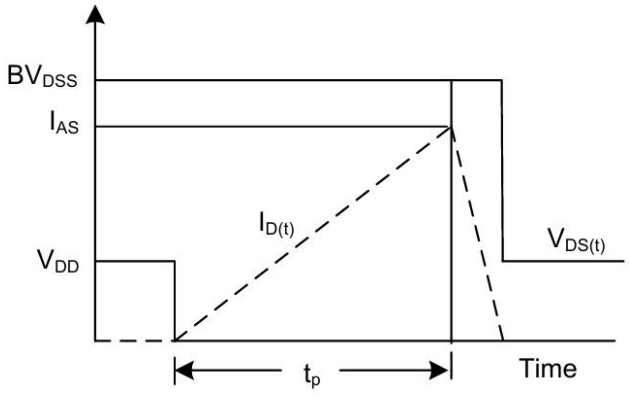
Gate Charge Test Circuit



Gate Charge Waveform



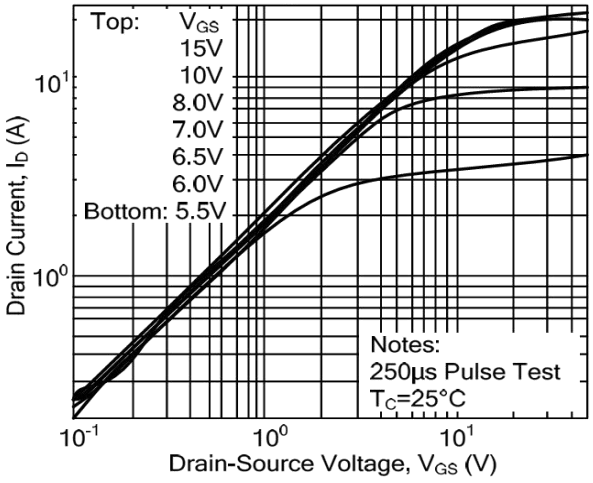
Unclamped Inductive Switching Test Circuit



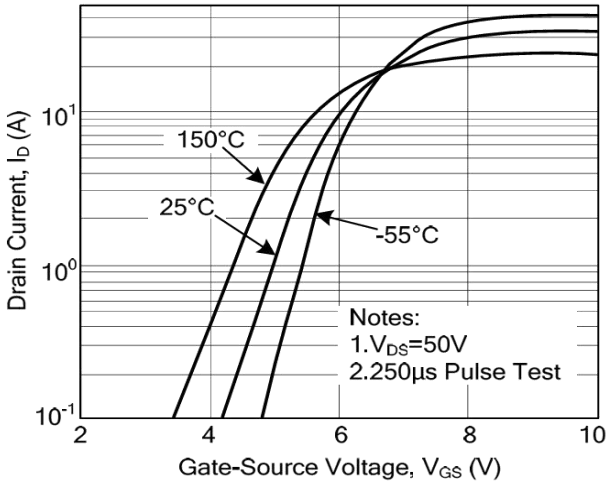
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

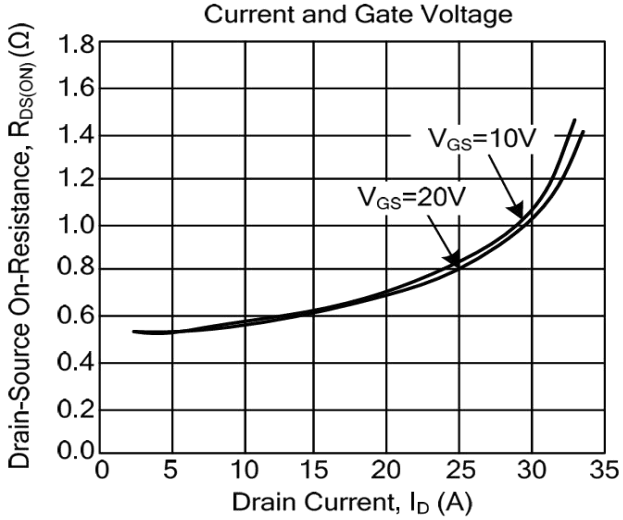
On-Resign Characteristics



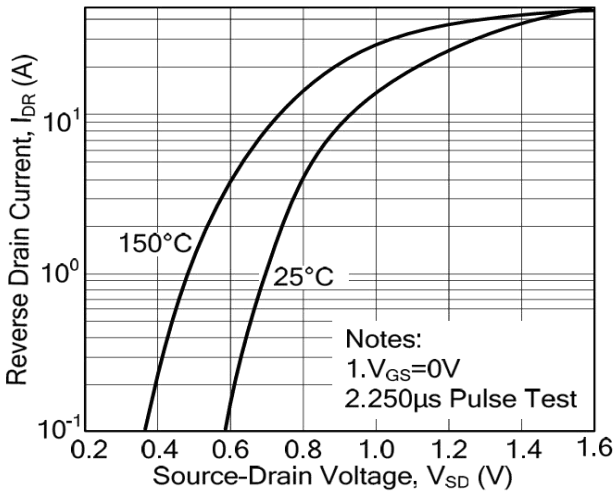
Transfer Characteristics



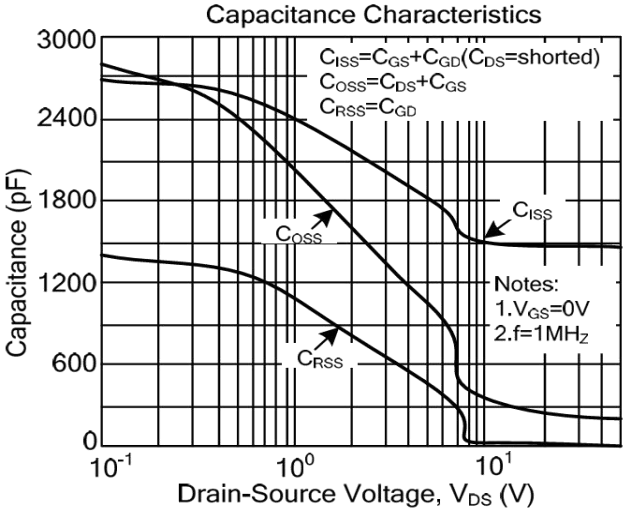
On-Resistance Variation vs.Drain Current and Gate Voltage



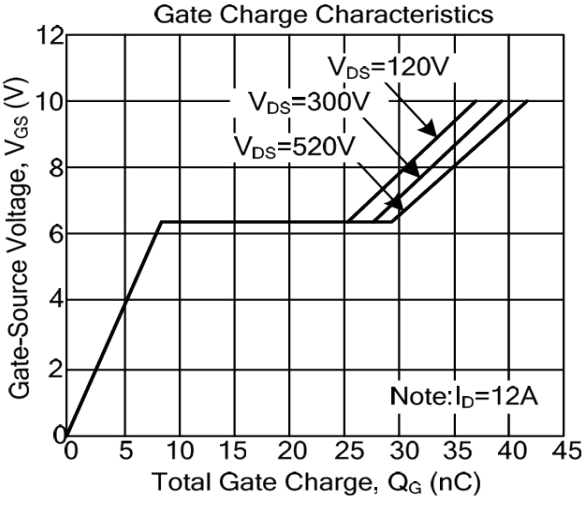
Body Diode Forward Voltage Variation vs. Source Current and Temperature



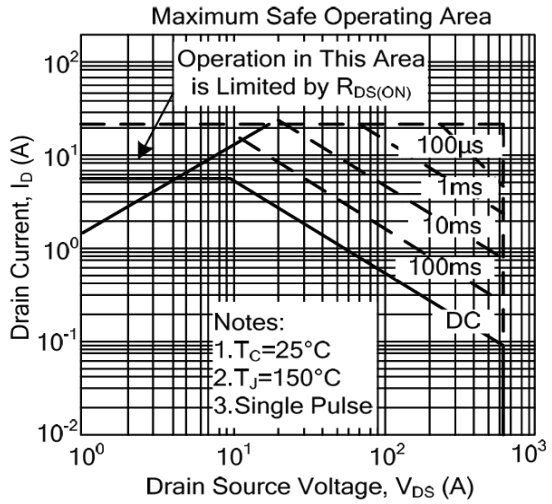
Capacitance Characteristics

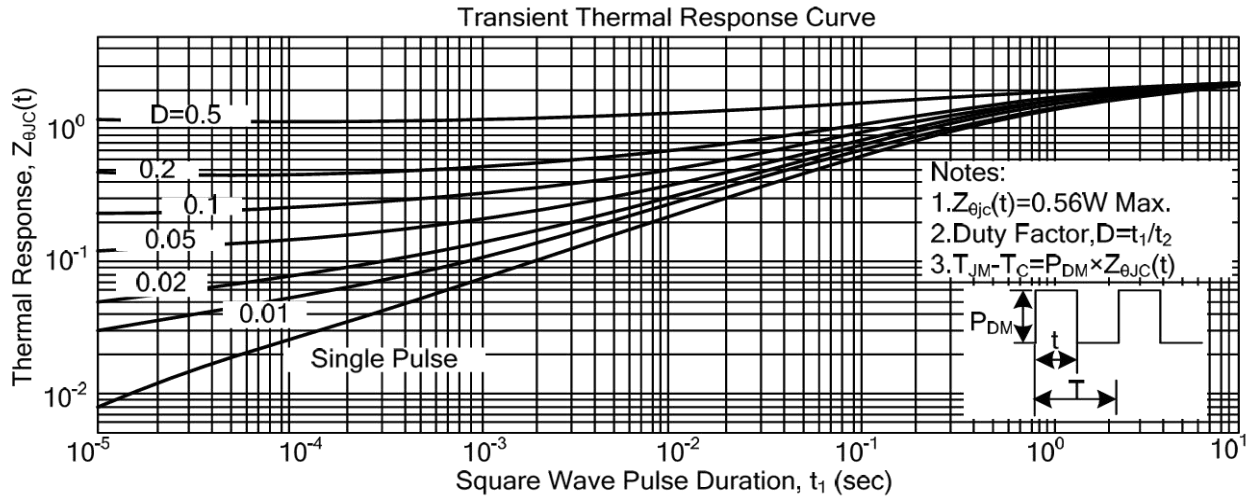


Gate Charge Characteristics

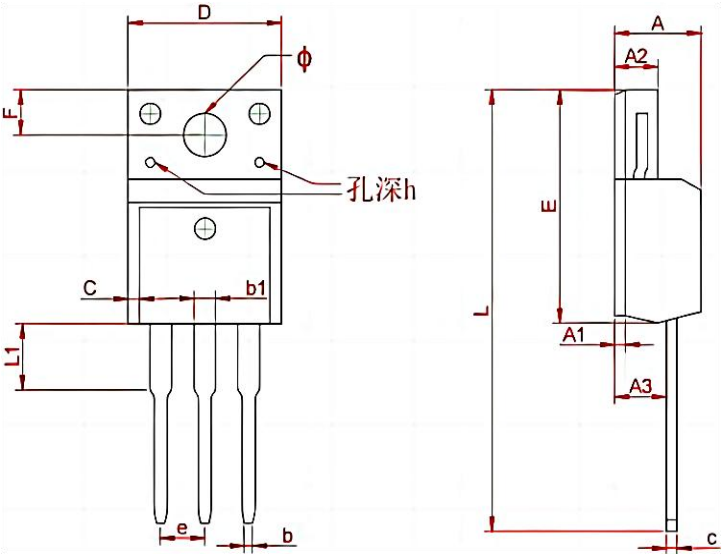


■ TYPICAL CHARACTERISTICS(Con.t)





■ TO - 220F PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters	
	Min	Max
A	4.300	4.750
A1	0.7 REF	
A2	2.300	2.850
A3	2.500	2.900
b	0.380	0.420
b1	1.220	1.280
C	1.08	1.200
c	0.480	0.520
D	10.15	10.450
E	15.700	15.950
e	2.574 TYP	
F	3.470 REF	
y	3.200 REF	
h	0.000	0.800
L	28.780	28.900
L1	2.990	3.100

■ TO - 220F PACKING INFORMATION

Package version	Tube dimensions LxW×H (mm)	Per Tube (pcs)	Tube per box	Inner box dimensions LxW×H (mm)	PCS/ Inner box	Outer box dimensions L×W×H(mm)	PCS/ Outer box
TO-220F	530*32*7	50	20	580*155*50	1000	602*277*188	5000