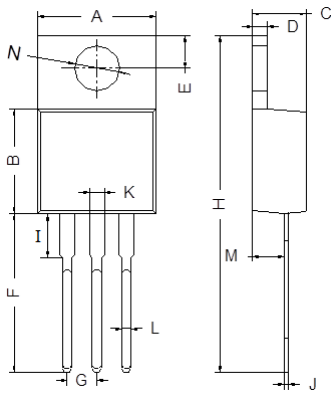
13N60

13A N-Channel Power MOSFET

Features

New technology for high voltage device
Low on-resistance and low conduction losses
Small package
Ultra Low Gate Charge cause lower driving requirements
100% Avalanche Tested
ROHS compliant

TO-220AB



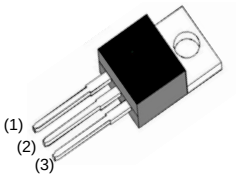
TO-220AB		
Dim	Min	Max
A	9.80	10.30
B	8.30	8.90
C	4.37	4.77
D	1.10	1.45
E	2.62	2.87
F	13.14	13.74
G	2.41	2.67
H	28.40	29.16
I	3.55	4.05
J	0.35	0.58
K	1.20	1.32
L	0.68	0.94
M	2.40	2.60
N	3.71	3.91
All Dimensions in mm		

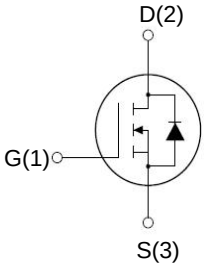
Mechanical Data

Case : TO-220AB
Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
Polarity : As marked
Mounting Position : Any

Application

Power factor correction（PFC）
Switched mode power supplies(SMPS)
Uninterruptible Power Supply（UPS）





Maximum Ratings And Electrical Characteristics

Ratings at 25℃ ambient temperature unless otherwise specified. Single phase half-wave 60Hz,resistive or inductive load, for capacitive load current derate by 20%.

Table 1. Absolute Maximum Ratings (T_C=25℃)

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-source voltage			V_{DS}	600	V
Gate-source voltage			V_{GS}	± 30	
Continuous drain current (T_J = 150 °C)	V_{GS} at 10 V	T_C = 25 °C	I_D	13	A
		T_C = 100 °C		8	
Pulsed drain current [a]			I_{DM}	32	
Linear derating factor				1.2	W/°C
Single pulse avalanche energy [b]			E_{AS}	136	mJ
Maximum power dissipation			P_D	147	W
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Drain-source voltage slope	T_J = 125 °C		dV/dt	70	V/ns
Reverse diode dV/dt [d]				32	
Soldering recommendations (peak temperature) [c]	For 10 s			300	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature
b. V_{DD} = 140 V, starting T_J = 25 °C, L = 28.2 mH, R_g = 25 Ω, I_{AS} = 3.1 A
c. 1.6 mm from case
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting T_J = 25 °C

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.85	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	600	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.73	-	V/°C
Gate-source threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	2.0	-	4.0	V
Gate-source leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
		V_{GS} = ± 30 V	-	-	± 1	µA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C	-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 7 A	-	0.269	0.309	Ω
Forward transconductance	g_{fs}	V_{DS} = 30 V, I_D = 7 A	-	3.8	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 100 V, f = 1 MHz	-	1205	-	pF
Output capacitance	C_{oss}		-	62	-	
Reverse transfer capacitance	C_{rss}		-	5	-	
Effective output capacitance, energy related [a]	$C_{o(er)}$	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	52	-	
Effective output capacitance, time related [b]	$C_{o(tr)}$		-	177	-	
Total gate charge	Q_g	V_{GS} = 10 V, I_D = 7 A, V_{DS} = 480 V	-	32	64	nC
Gate-source charge	Q_{gs}		-	8	-	
Gate-drain charge	Q_{gd}		-	13	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 480 V, I_D = 7 A, V_{GS} = 10 V, R_g = 9.1 Ω	-	15	30	ns
Rise time	t_r		-	19	38	
Turn-off delay time	$t_{d(off)}$		-	35	70	
Fall time	t_f		-	15	30	
Gate input resistance	R_g	f = 1 MHz, open drain	0.38	0.75	1.5	Ω
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	13	A
Pulsed diode forward current	I_{SM}		-	-	32	
Diode forward voltage	V_{SD}	T_J = 25 °C, I_S = 7 A, V_{GS} = 0 V	-	-	1.2	V
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = I_S = 7 A, dI/dt = 100 A/µs, V_R = 25 V	-	281	-	ns
Reverse recovery charge	Q_{rr}		-	3.4	-	µC
Reverse recovery current	I_{RRM}		-	22	-	A

Notes

a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 1 - Typical Output Characteristics

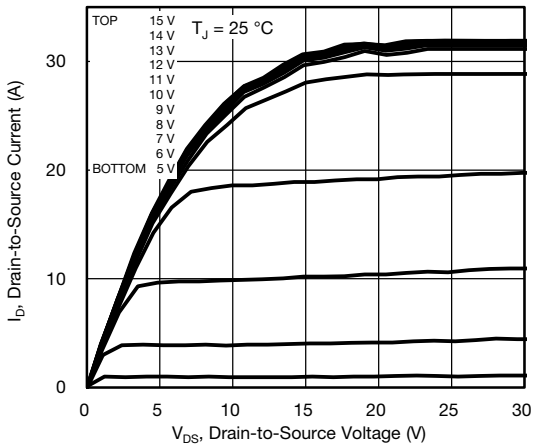


Fig. 2 - Typical Output Characteristics

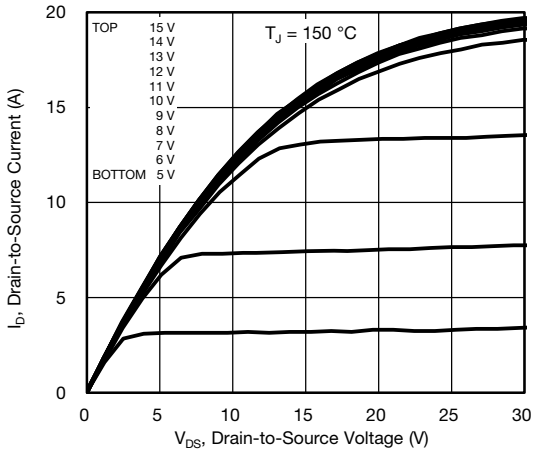


Fig. 3 - Typical Transfer Characteristics

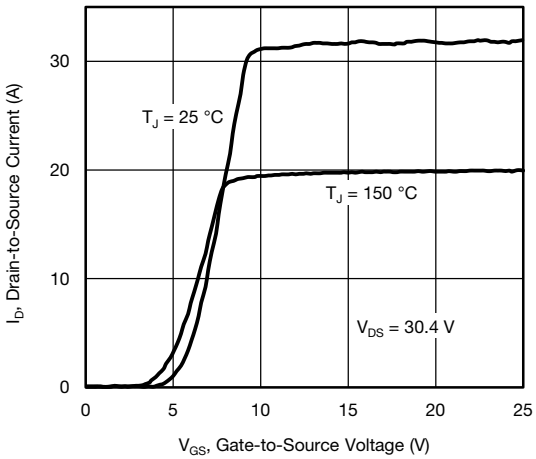


Fig. 4 - Normalized On-Resistance vs. Temperature

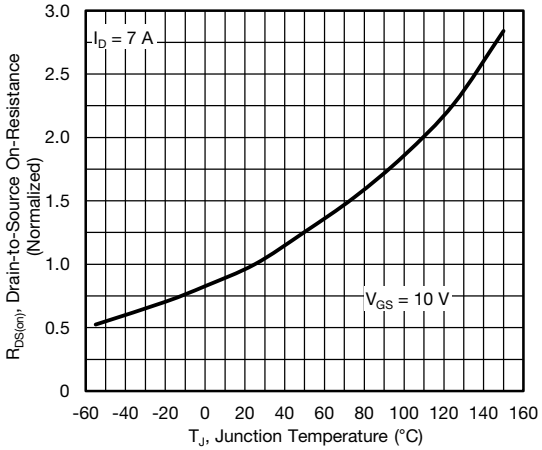


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

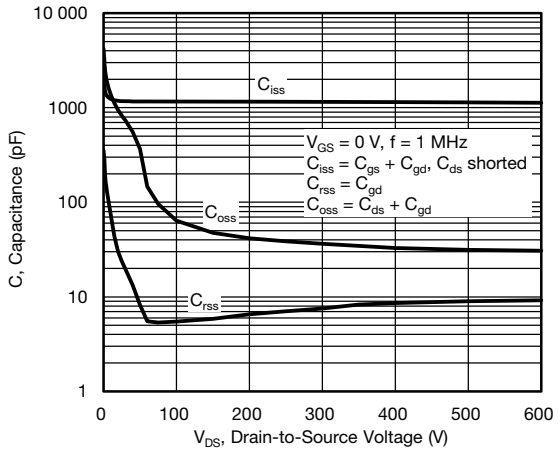


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

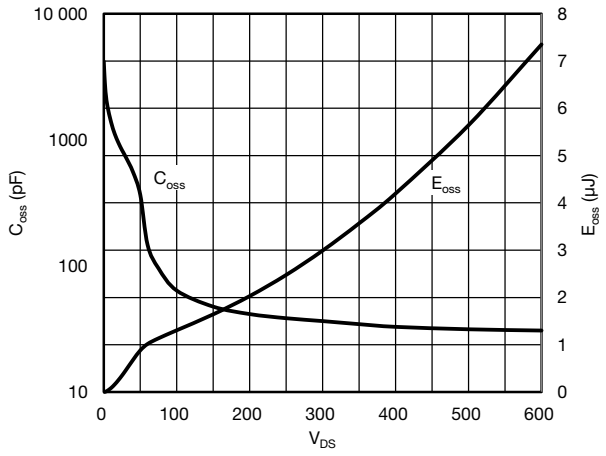


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

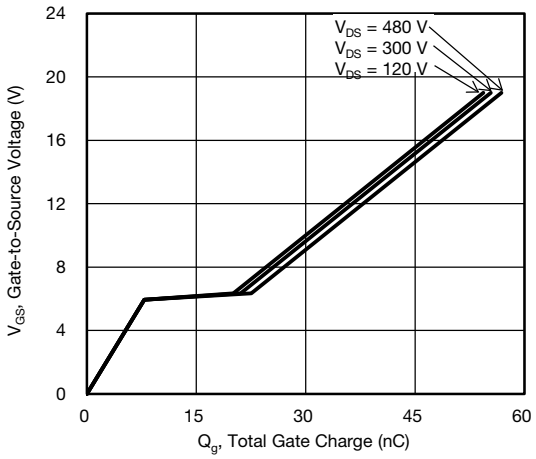


Fig. 10 - Maximum Drain Current vs. Case Temperature

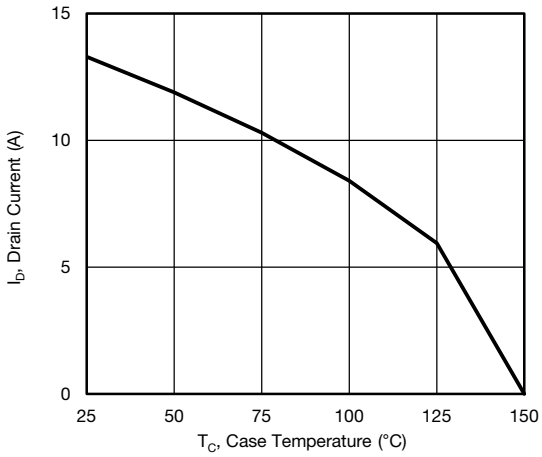


Fig. 8 - Typical Source-Drain Diode Forward Voltage

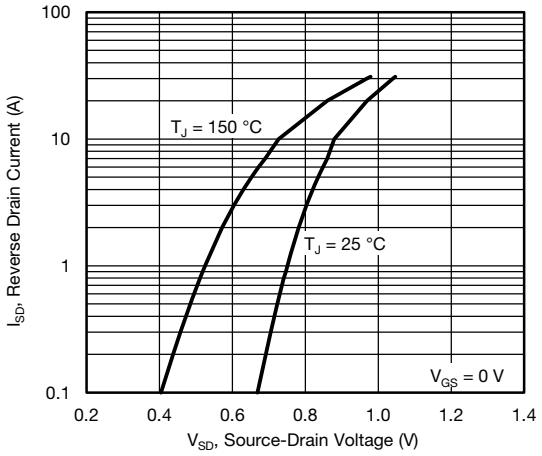


Fig. 11 - Temperature vs. Drain-to-Source Voltage

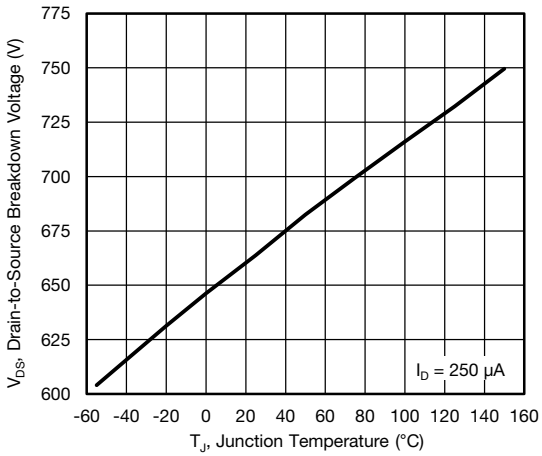
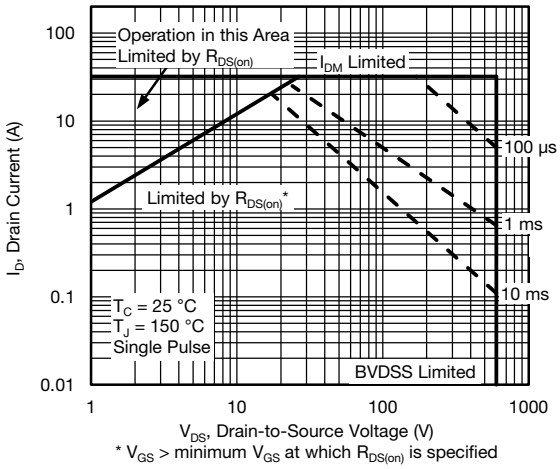


Fig. 9 - Maximum Safe Operating Area



* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

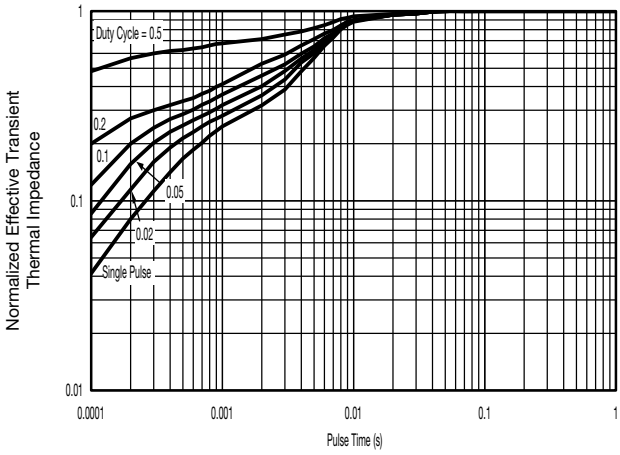
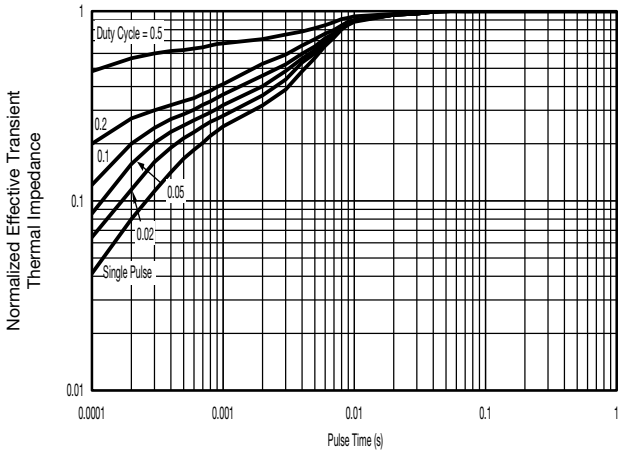


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case



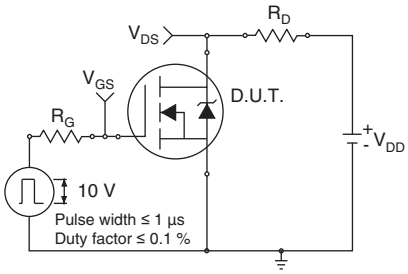


Fig. 13 - Switching Time Test Circuit

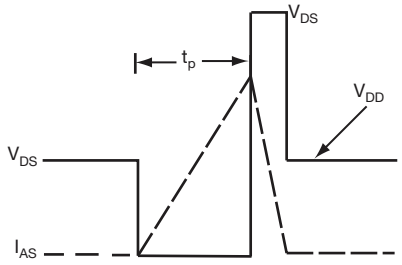


Fig. 16 - Unclamped Inductive Waveforms

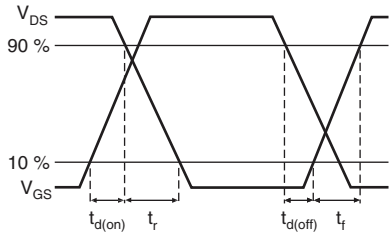


Fig. 14 - Switching Time Waveforms

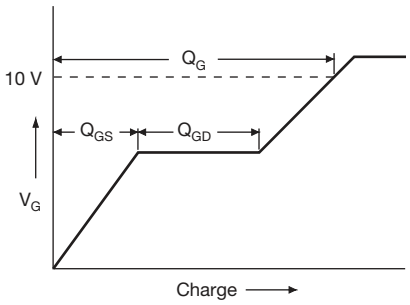


Fig. 17 - Basic Gate Charge Waveform

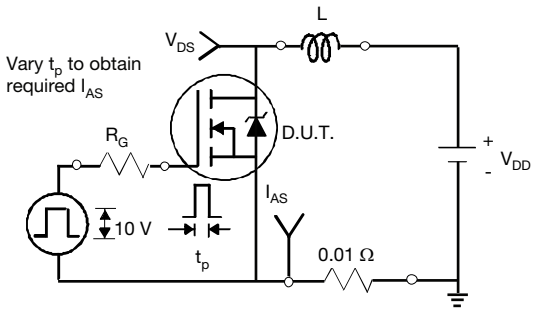


Fig. 15 - Unclamped Inductive Test Circuit

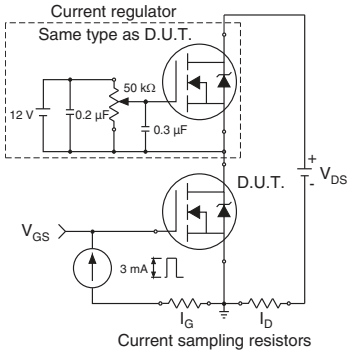


Fig. 18 - Gate Charge Test Circuit