

N-Channel Power MOSFET 24A, 500Volts

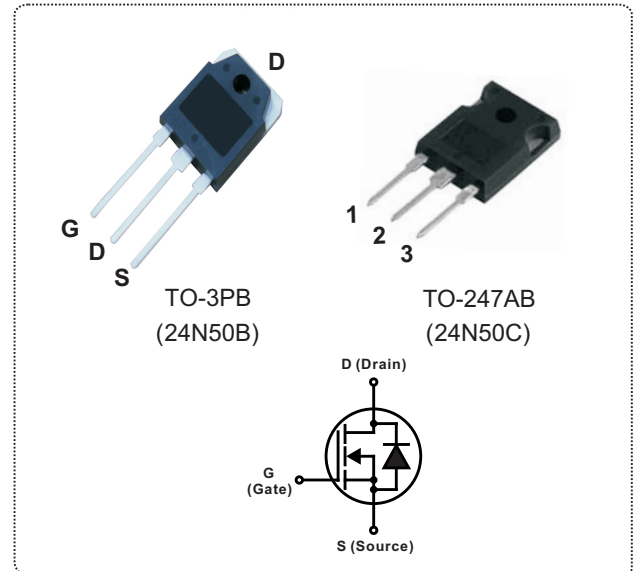
DESCRIPTION

The Nell **24N50** is a three-terminal silicon device with current conduction capability of 24A, fast switching speed, low on-state resistance, breakdown voltage rating of 500V, and max. threshold voltage of 4 volts.

They are designed for use in applications such as switched mode power supplies, DC to DC converters, **PWM** motor controls, bridge circuits and general purpose switching applications.

FEATURES

- $R_{DS(ON)} = 0.2\Omega$ @ $V_{GS} = 10V$
- Ultra low gate charge(120nC Max.)
- Low reverse transfer capacitance ($C_{RSS} = 55pF$ typical)
- Fast switching capability
- 100% avalanche energy specified
- Improved dv/dt capability
- 150°C operation temperature



PRODUCT SUMMARY

I_D (A)	24
V_{DSS} (V)	500
$R_{DS(ON)}$ (Ω)	0.2 @ $V_{GS} = 10V$
Q_G (nC) max.	120

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ C$ unless otherwise specified)

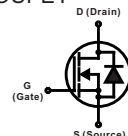
SYMBOL	PARAMETER	TEST CONDITIONS		VALUE	UNIT
V_{DSS}	Drain to Source voltage	$T_J = 25^\circ C$ to $150^\circ C$		500	V
V_{DGR}	Drain to Gate voltage	$R_{GS} = 20K\Omega$		500	
V_{GS}	Gate to Source voltage			± 30	
I_D	Continuous Drain Current	$T_C = 25^\circ C$		24	A
		$T_C = 100^\circ C$		15.2	
I_{DM}	Pulsed Drain current(Note 1)			96	
I_{AR}	Avalanche current(Note 1)			24	mJ
E_{AR}	Repetitive avalanche energy(Note 1)	$I_{AR} = 24A, R_{GS} = 50\Omega, V_{GS} = 10V$		29	
E_{AS}	Single pulse avalanche energy(Note 2)	$I_{AS} = 24A, L = 3.4mH$		1100	
dv/dt	Peak diode recovery dv/dt(Note 3)			15	V / ns
P_D	Total power dissipation (derate above $25^\circ C$)	$T_C = 25^\circ C$	TO-247AB	290 (2.33)	W(W / $^\circ C$)
			TO-3PB	270 (2.2)	
T_J	Operation junction temperature			-55 to 150	$^\circ C$
T_{STG}	Storage temperature			-55 to 150	
T_L	Maximum soldering temperature, for 10 seconds	1.6mm from case		300	
	Mounting torque, #6-32 or M3 screw			10 (1.1)	lbf-in (N·m)

Note: 1. Repetitive rating: pulse width limited by junction temperature.
 2. $I_{AS} = 24A, L = 3.4mH, V_{DD} = 50V, R_{GS} = 25\Omega$, starting $T_J = 25^\circ C$.
 3. $I_{SD} \leq 24A, di/dt \leq 350A/\mu s, V_{DD} \leq V_{(BR)DSS}$, starting $T_J = 25^\circ C$.

Nell High Power Products

THERMAL RESISTANCE						
SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT	
$R_{th(j-c)}$	Thermal resistance, junction to case			0.43	°C/W	
$R_{th(c-s)}$	Thermal resistance, case to heat sink		0.24			
$R_{th(j-a)}$	Thermal resistance, junction to ambient			40		

ELECTRICAL CHARACTERISTICS (T _C = 25°C unless otherwise specified)							
SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
◎ OFF CHARACTERISTICS							
V _{(BR)DSS}	Drain to source breakdown voltage	I _D = 250μA, V _{GS} = 0V		500			V
ΔV _{(BR)DSS} /ΔT _J	Breakdown voltage temperature coefficient	I _D = 250μA, V _{DS} = V _{GS}			0.53		V/°C
I _{DSS}	Drain to source leakage current	V _{DS} = 500V, V _{GS} = 0V	T _C = 25°C			50	μA
		V _{DS} = 400V, V _{GS} = 0V	T _C = 125°C			500	
I _{GSS}	Gate to source forward leakage current	V _{GS} = 30V, V _{DS} = 0V				100	nA
	Gate to source reverse leakage current	V _{GS} = -30V, V _{DS} = 0V				-100	
◎ ON CHARACTERISTICS							
R _{DS(ON)}	Static drain to source on-state resistance	V _{GS} = 10V, I _D = 12A			0.16	0.2	Ω
V _{GS(TH)}	Gate threshold voltage	V _{GS} = V _{DS} , I _D = 250μA		3		5	V
g _{fs}	Forward transconductance	V _{DS} = 50V, I _D = 12A (Note 1)			22		S
◎ DYNAMIC CHARACTERISTICS							
C _{ISS}	Input capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1MHz			3500	4500	pF
C _{OSS}	Output capacitance				520	670	
C _{RSS}	Reverse transfer capacitance				55	70	
◎ SWITCHING CHARACTERISTICS							
t _{d(ON)}	Turn-on delay time	V _{DD} = 250V, V _{GS} = 10V I _D = 24A, R _{GS} = 25Ω (Note 1,2)			80	170	ns
t _r	Rise time				250	500	
t _{d(OFF)}	Turn-off delay time				200	400	
t _f	Fall time				155	320	
Q _G	Total gate charge	V _{DD} = 400V, V _{GS} = 10V I _D = 24A, (Note 1,2)			90	120	nC
Q _{GS}	Gate to source charge				23		
Q _{GD}	Gate to drain charge (Miller charge)				52		

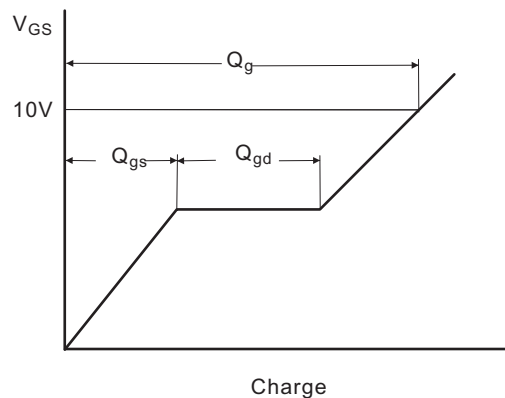
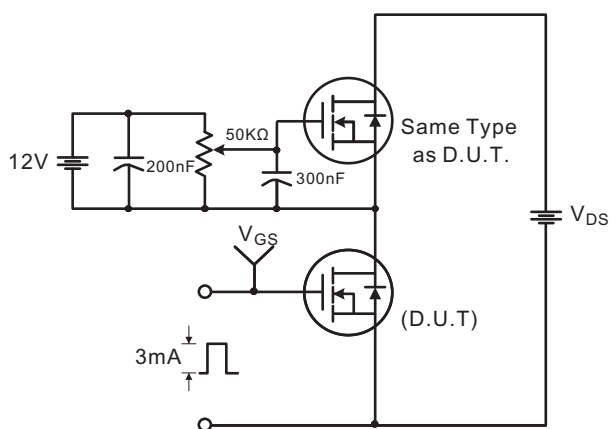
SOURCE TO DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)						
SYMBOL	PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SD}	Diode forward voltage	$I_{SD} = 24\text{A}$, $V_{GS} = 0\text{V}$			1.4	V
I_S (I_{SD})	Continuous source to drain current	Integral reverse P-N junction diode in the MOSFET			24	A
I_{SM}	Pulsed source current				96	
t_{rr}	Reverse recovery time	$I_{SD} = 24\text{A}$, $V_{GS} = 0\text{V}$, $dI_F/dt = 100\text{A}/\mu\text{s}$			250	ns
Q_{rr}	Reverse recovery charge			1.1		μC

Note: 1. Pulse test: Pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.

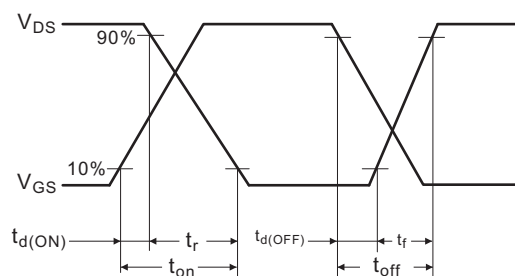
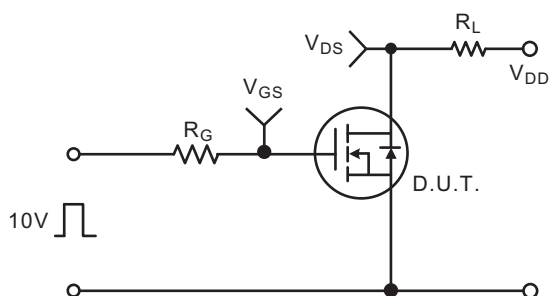
ORDERING INFORMATION SCHEME

	24	N	50	B
Current rating, I_D	24 = 24A			
MOSFET series	N = N-Channel			
Voltage rating, V_{DS}	50 = 500V			
Package type	B = TO-3PB C = TO-247AB			

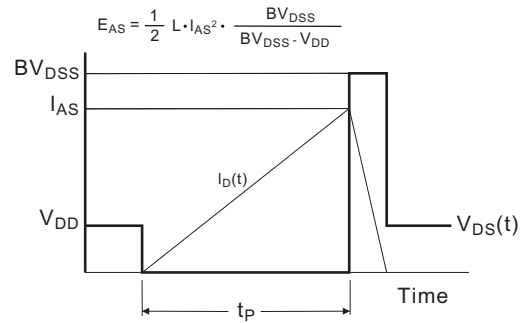
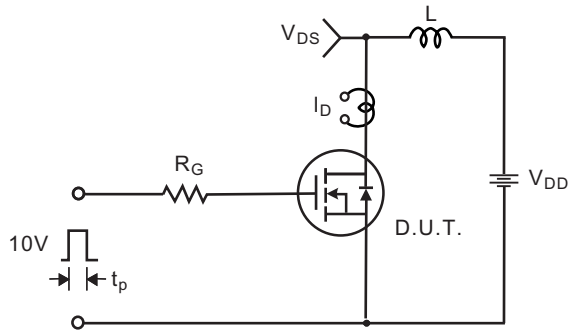
■ Gate charge test circuit & waveform



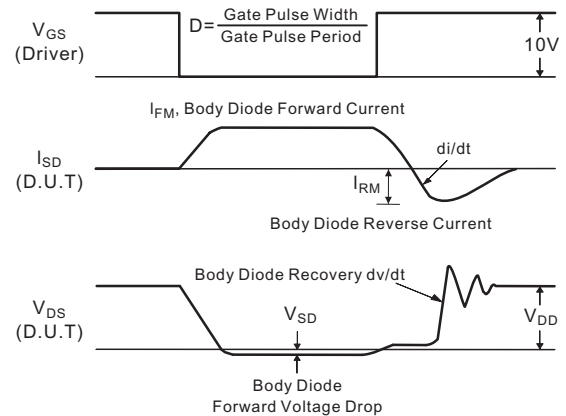
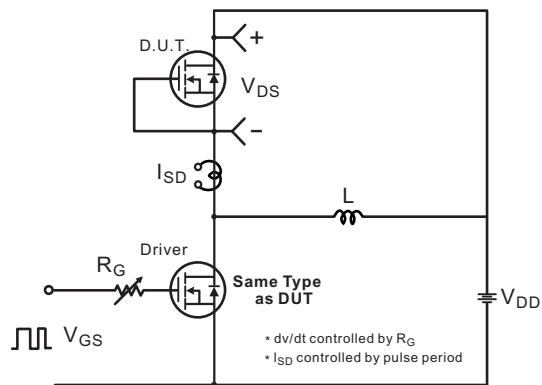
■ Resistive switching test circuit & Waveforms



■ Unclamped Inductive switching test circuit & Waveforms



■ Peak diode recovery dv/dt test circuit & Waveforms



■ TYPICAL CHARACTERISTICS

Fig.1 On-State characteristics

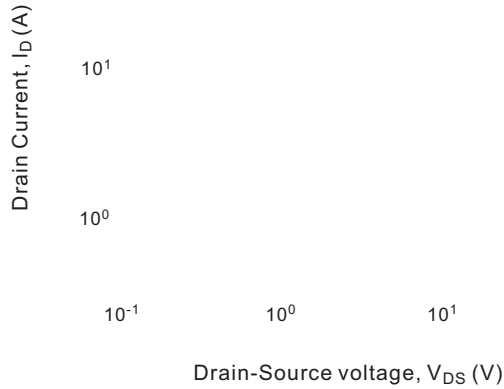


Fig.2 Transfer characteristics

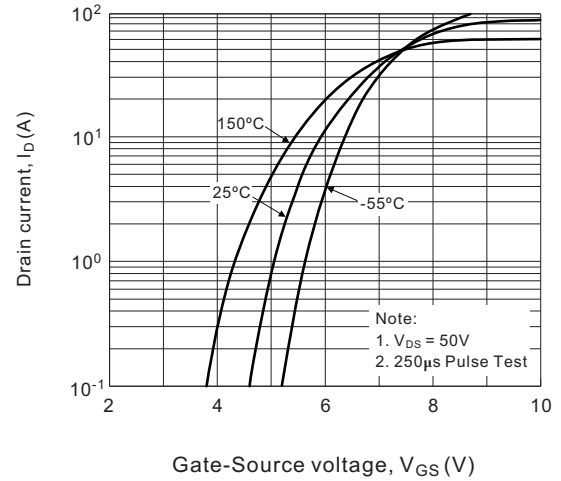


Fig.3 On-Resistance variation vs. Drain current and gate voltage

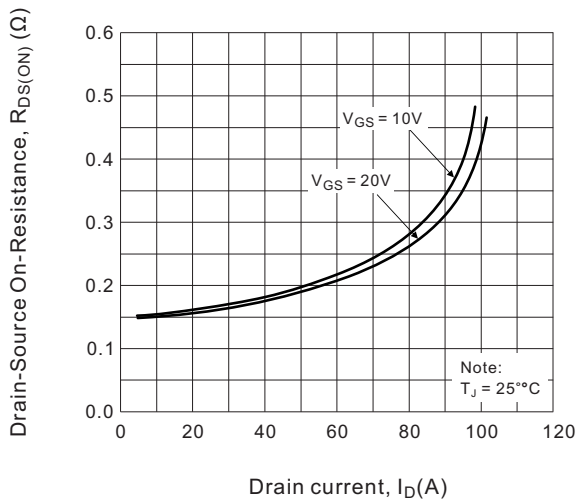


Fig.4 Body diode forward voltage variation with source current and temperature

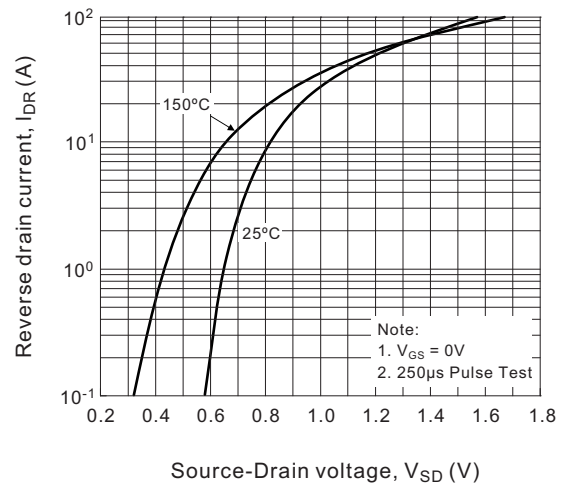


Fig.5 Capacitance characteristics

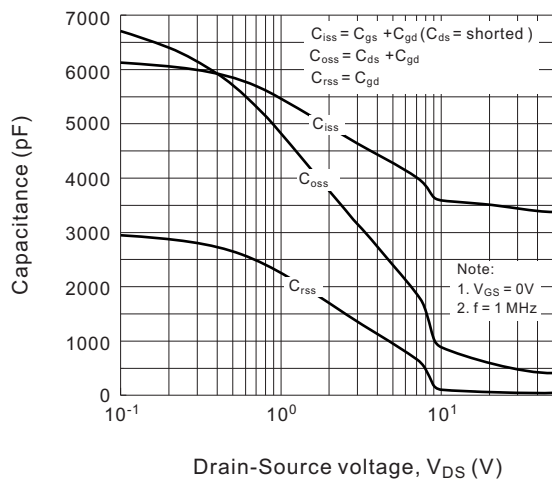


Fig.6 Gate charge characteristics

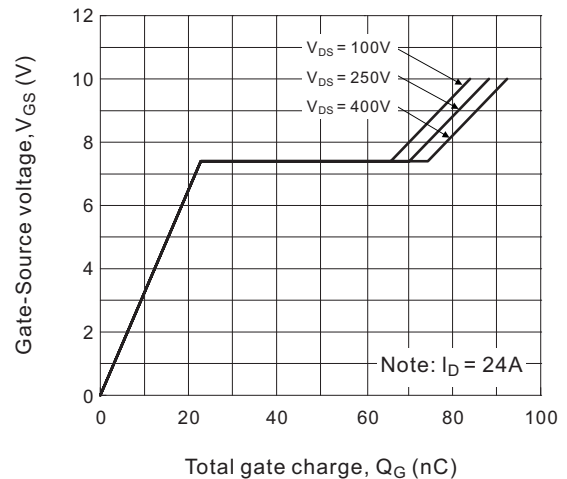


Fig.7 Breakdown voltage variation vs. Temperature

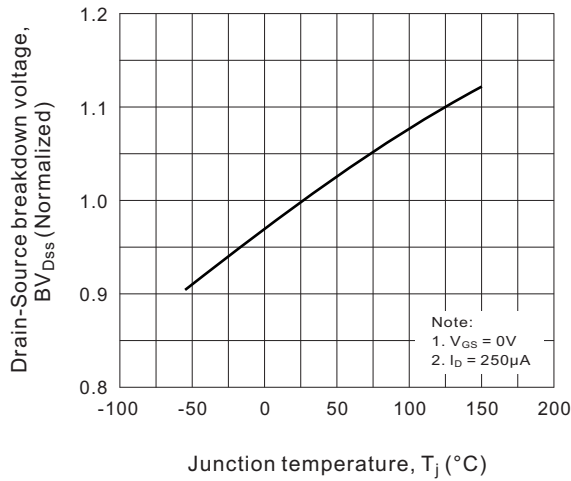


Fig.8 On-Resistance variation vs. Temperature

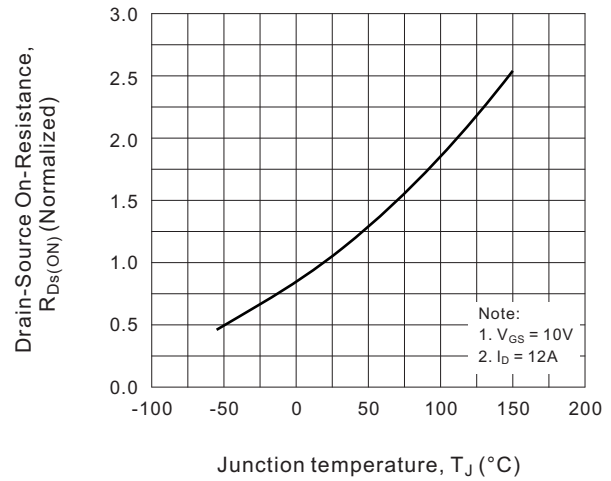


Fig.9 Maximum safe operating area

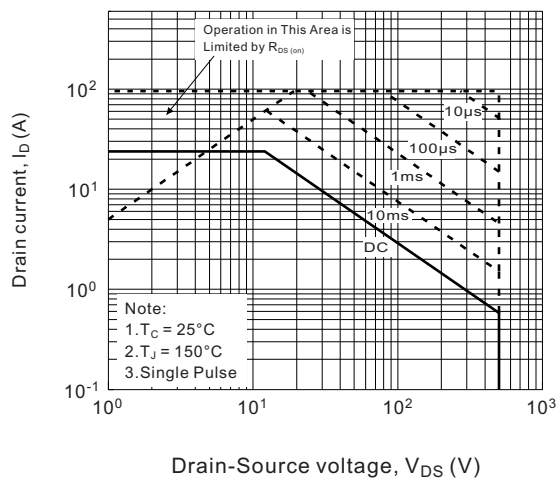


Fig.10 Maximum drain current vs. Case temperature

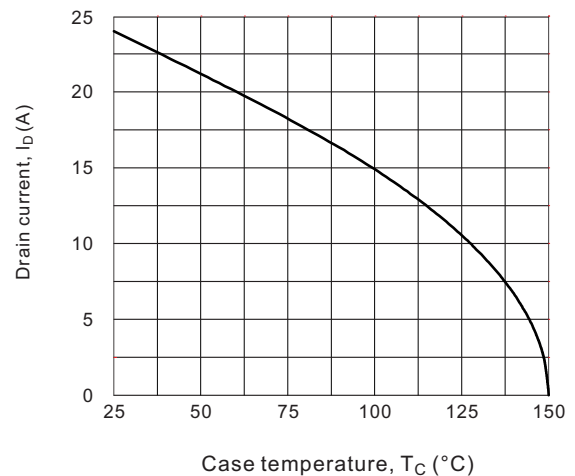
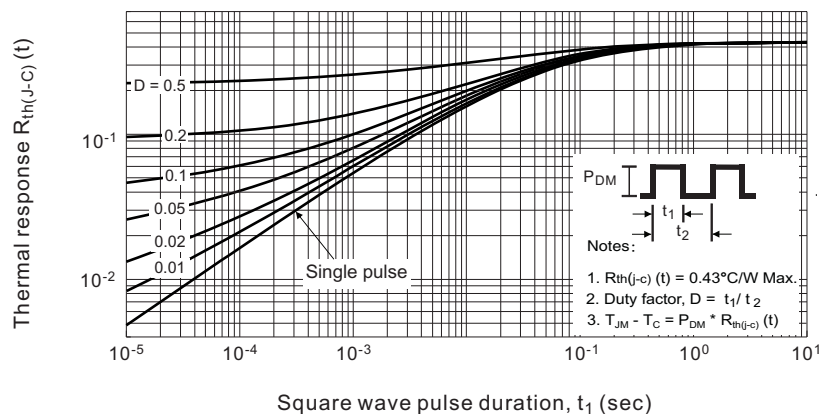
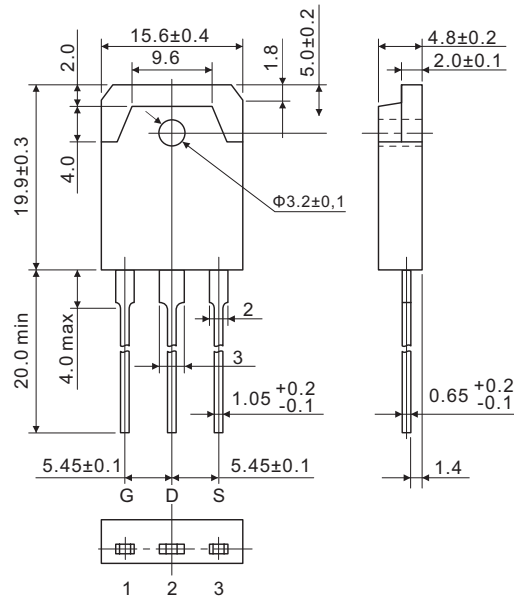


Fig.11 Transient thermal response curve

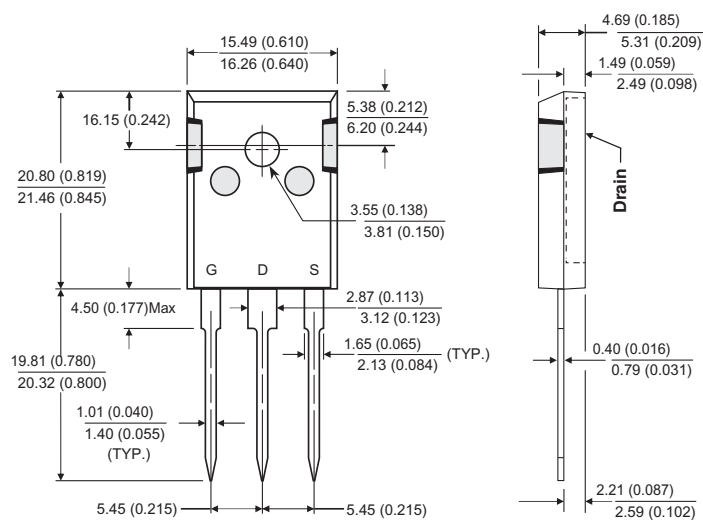


TO-3PB



All dimensions in millimeters

TO-247AB



All dimensions in millimeters(inches)

