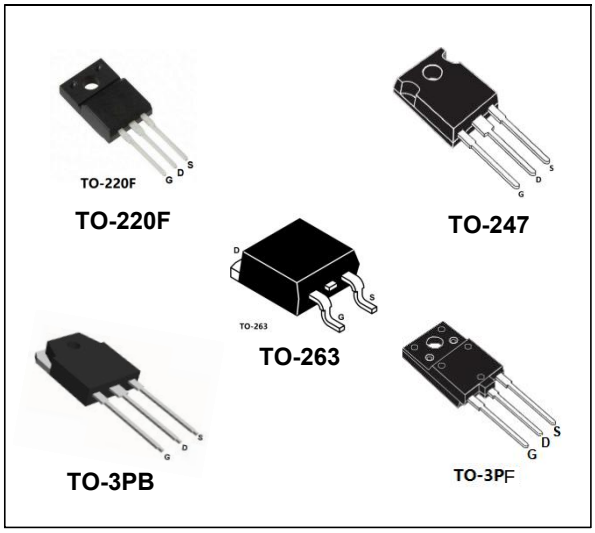
N-channel 1500 V, 6 Ω, 4 A, Power MOSFET in TO-263,TO-247,TO-220F, TO-3PB,TO-3PF

Features

Type	V_{DSS}	R_{DS}(on) max.	I_D	P_{TOT}
SL4N150P	1500 V	< 9 Ω	4 A	63 W
SL4N150F	1500 V	< 9 Ω	4 A	140 W
SL4N150K	1500 V	< 9 Ω	4 A	140 W
SL4N150B	1500 V	< 9 Ω	4 A	80 W
SL4N150T	1500 V	< 9 Ω	4 A	140 W



- 100% avalanche tested
- Intrinsic capacitances and Q_g minimized
- High speed switching

Application

Switching applications

Description

Slkor has designed an advanced family of very high voltage Power MOSFETs with outstanding performances. The strengthened layout coupled with the company's proprietary edge termination structure, gives the lowest $R_{DS(on)}$ per area, unrivalled gate charge and switching characteristics.

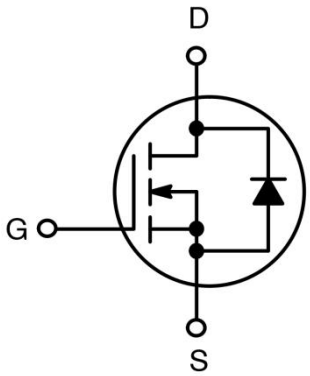


Table 1. Device summar

Order codes	Package	Packaging
SL4N150P	TO-3PF	Tube
SL4N150F	TO-220F	Tube
SL4N150K	TO-263	Tube
SL4N150B	TO-3PB	Tube
SL4N150T	TO-247	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-3P,TO-3PH,TO-247	TO-220F	
V_{DS}	Drain-source voltage (V_{GS} = 0)	1500		V
V_{GS}	Gate-source voltage	± 30		V
I_D	Drain current (continuous) at T_C = 25 °C	4	4(1)	A
I_D	Drain current (continuous) at T_C = 100 °C	2.6	2.6 (1)	A
I_{DM} (1)	Drain current (pulsed)	10	10 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	140	63	W
V_{ISO}	Insulation with stand voltage (RMS) from all three leads to external heat sink (t=1 s;T_C=25 °C)		3500	V
	Derating factor	1.18	0.63	W/°C
T_{stg}	storage temperature	-50 to 150		°C
T_j	Max. operating junction temperature	150		°C

1. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	TO-3P	TO-247	TO-263	TO-3PH,TO-220F	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.9		0.63	2	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	63.5	50	35	50	°C/W
T_j	Maximum lead temperature for soldering purpose	300				°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	4	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	510	mJ

2 Electrical characteristics (T_{case} = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Testconditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	1500			V
I_{DSS}	Zero gate voltage	V_{DS} = Max rating			10	µA
	drain current (V = 0)	V = Max rating, T =125 °C			500	µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 30 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3.2	4.5	6	V
$R_{DS(on}$	static drain-source on resistance	V_{GS} = 10 V, I_D = 1.3 A		5.8	9	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 30 V, I_D = 1.3 A	-	2.6	-	S
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	1408	-	pF
C_{oss}	Output capacitance			153		pF
C_{rss}	Reverse transfer capacitance			19.8		pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{DS}=0 to 1200 V, V_{GS} = 0	-	138	-	pF
R_g	Gate input resistance	f=1 MHz Gate DC Bias=0 Test signal level=20 mV open drain	-	5.3	-	Ω
Q_g	Total gate charge	V_{DD} = 1200 V, I_D = 4 A, V_{GS} = 10 V *(see Figure 19)*	-	44	-	nC
Qgs	Gate-source charge			6.9		nC
Qgd	Gate-drain charge			23.8		nC

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V = 800 V, I = 1.25 A, R_G = 4.8 Ω, V_{GS} = 10 V		26		ns
tr	Rise time			51		ns
td(off)	Turn-off-delay time		-	48	-	ns
tf	Fall time			69		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		 -		4 10	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 4 A, V_{GS} = 0	-		1.63	V
t_{rr} Qrr IRRM	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 4 A, di/dt = 100 A/µs V_{DD}= 60 V	 -	390 2.2 12.6		ns µc A
t_{rr} Qrr IRRM	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 4 A, di/dt = 100 A/µs V_{DD}= 60 V, Tj = 150 °C	 -	510 3.8 13.2		ns µc A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristcs (curves)

Figure 2. Safe operating area for TO-3PH

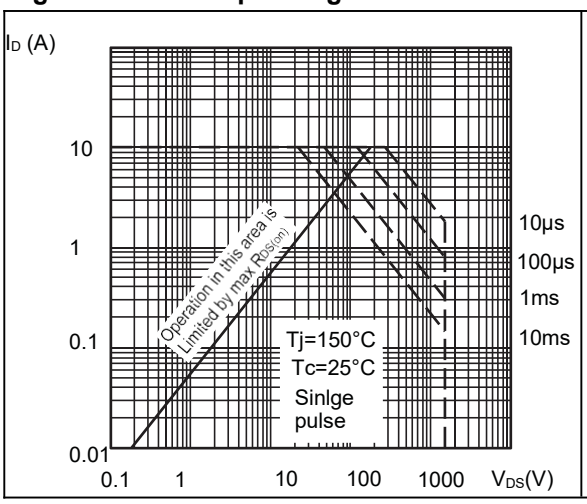


Figure 3. Thermal impedance for TO-3PH

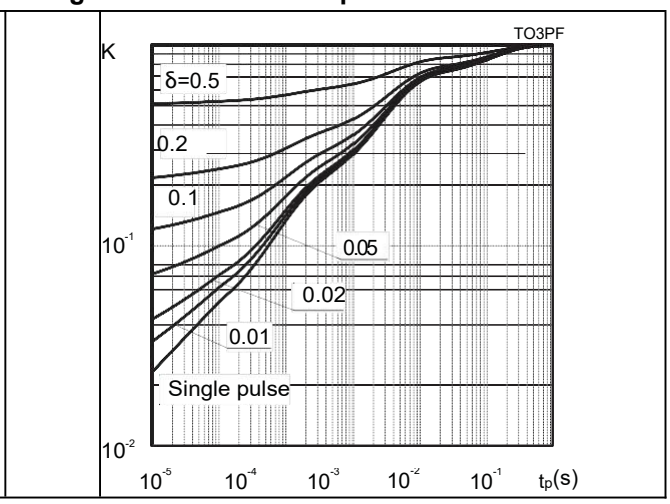


Figure 4. Safe operating area for TO-220

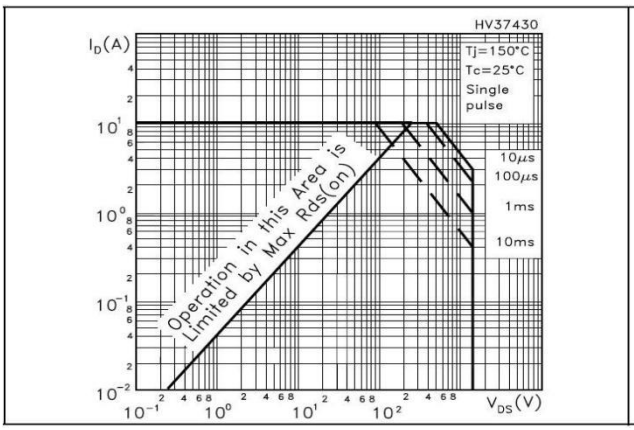


Figure 5. Thermal impedance for TO-220

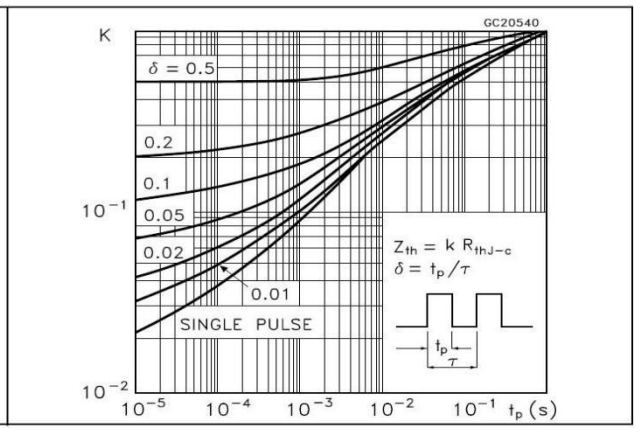


Figure 6. Safe operating area for TO-247

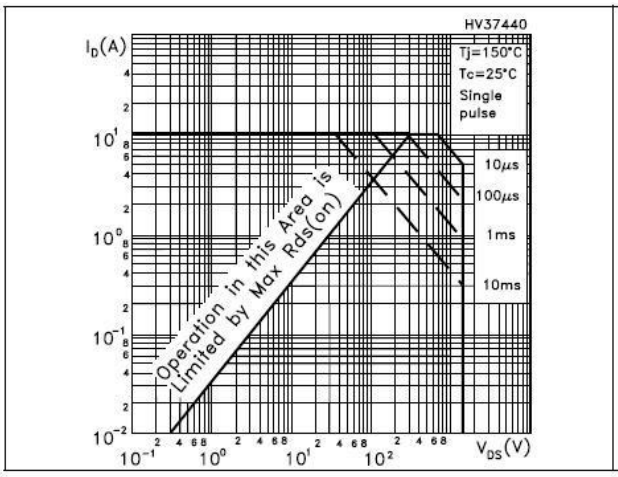


Figure 7. Thermal impedance for TO-247

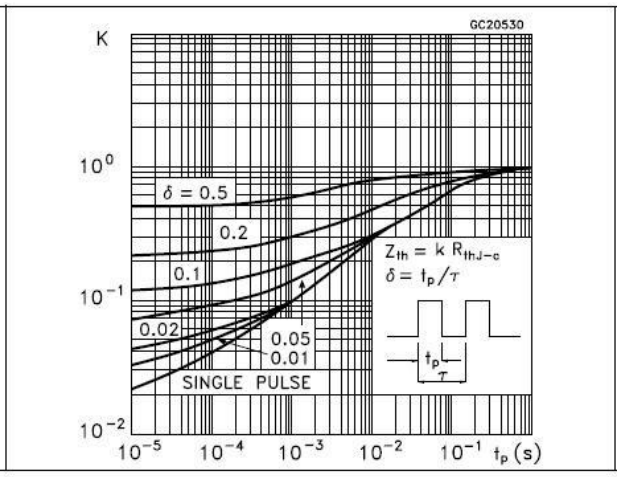


Figure 8. Output characteristics

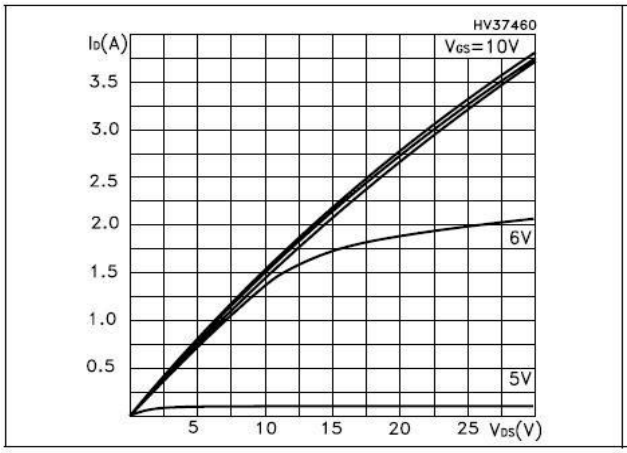


Figure 9. Transfer characteristics

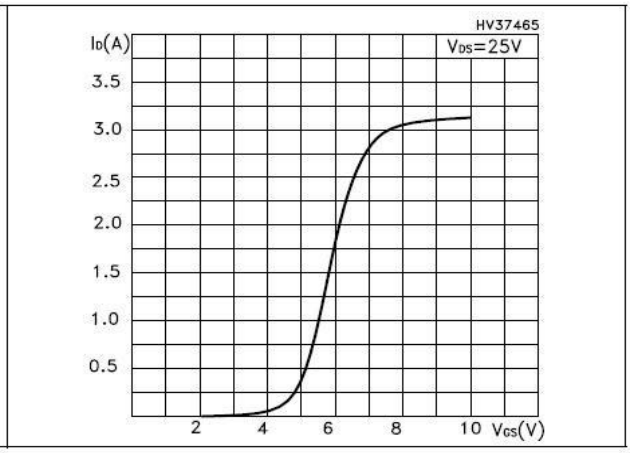


Figure 10. Normalized BV_{DSS} vs. temperature

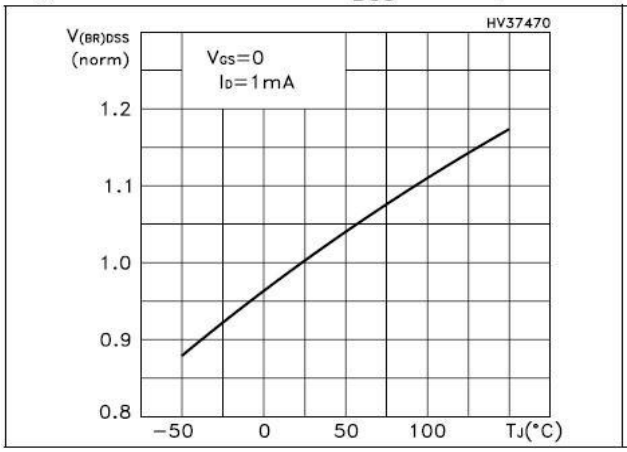


Figure 11. Static drain-source on resistance

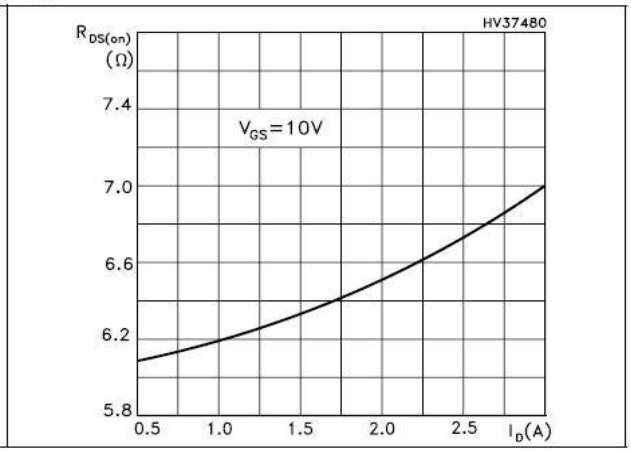


Figure 12. Gate charge vs. gate-source voltage

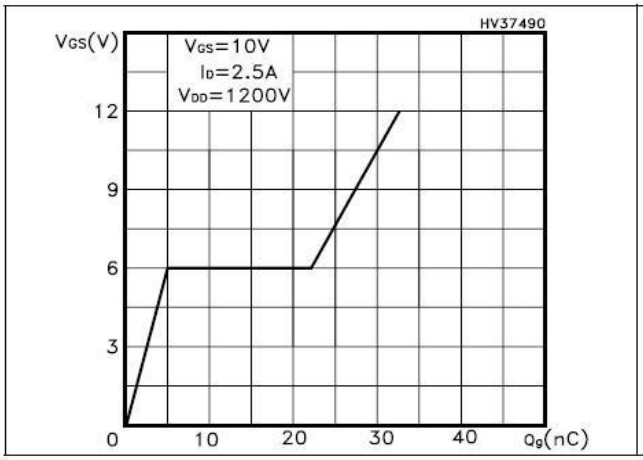


Figure 13. Capacitance variations

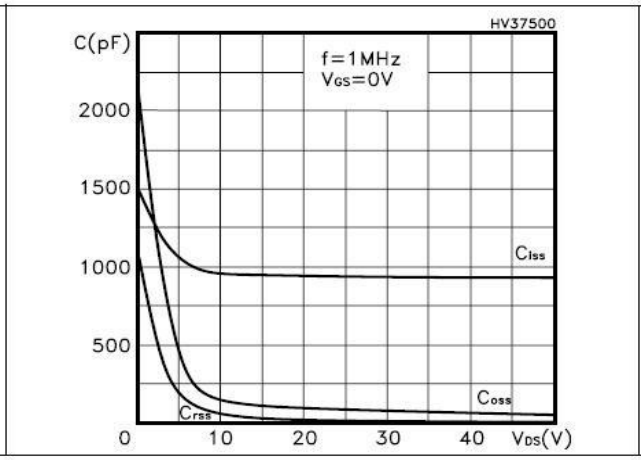


Figure 14. Normalized gate threshold voltage vs. temperature

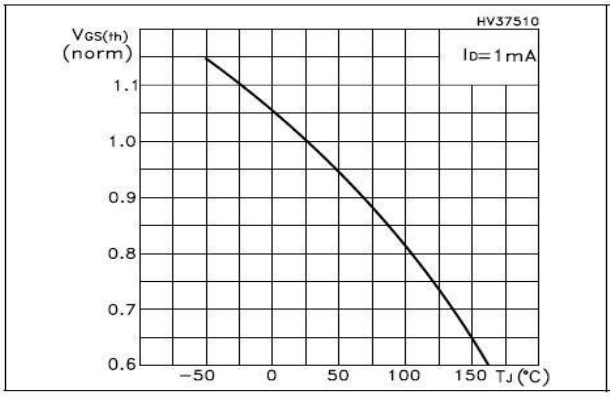


Figure 15. Normalized on resistance vs. temperature

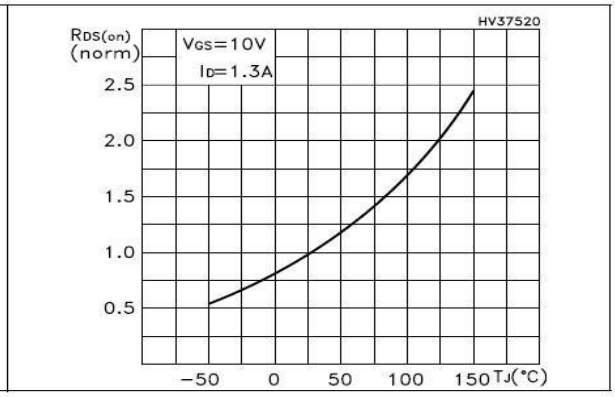


Figure 16. Source-drain diode forward characteristics

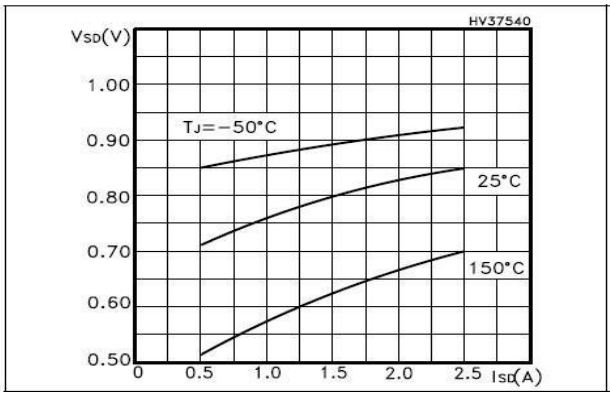
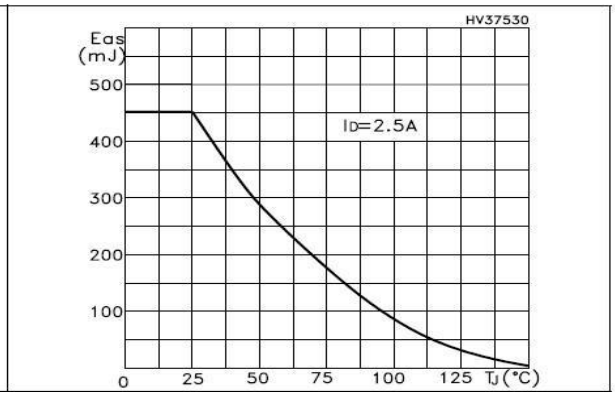


Figure 17. Maximum avalanche energy vs Tj



3 Test circuits

Figure 18. Switching times test circuit for resistive load

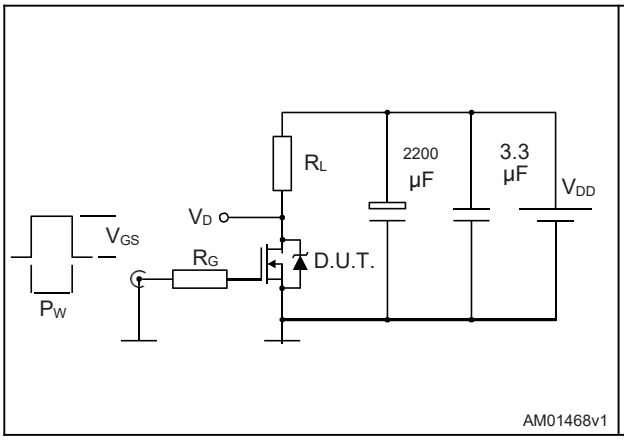


Figure 19. Gate charge test circuit

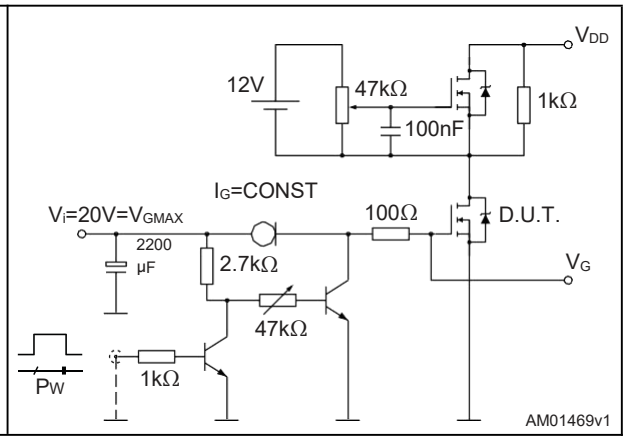


Figure 20. Test circuit for inductive load switching and diode recovery times

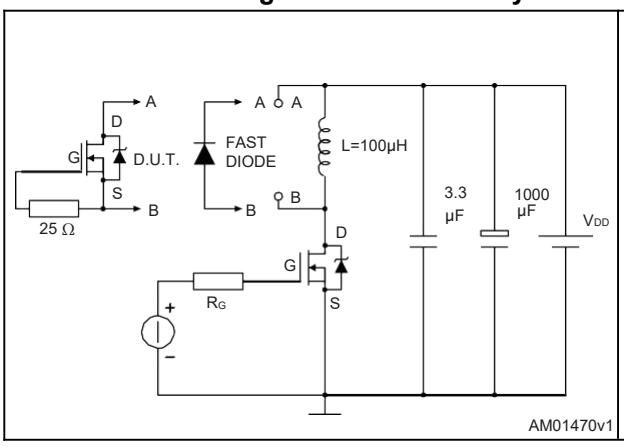


Figure 21. Unclamped inductive load test circuit

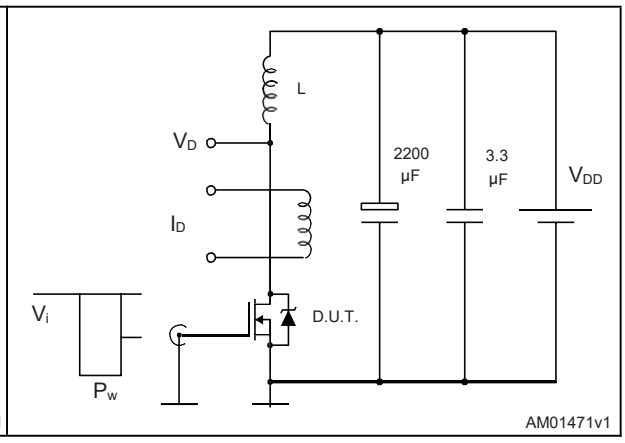


Figure 22. Unclamped inductive waveform

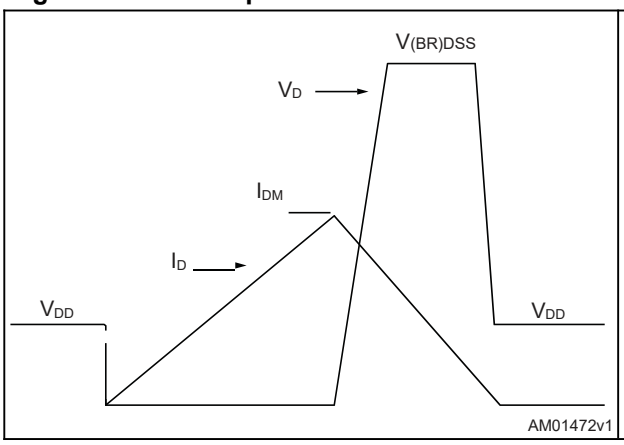
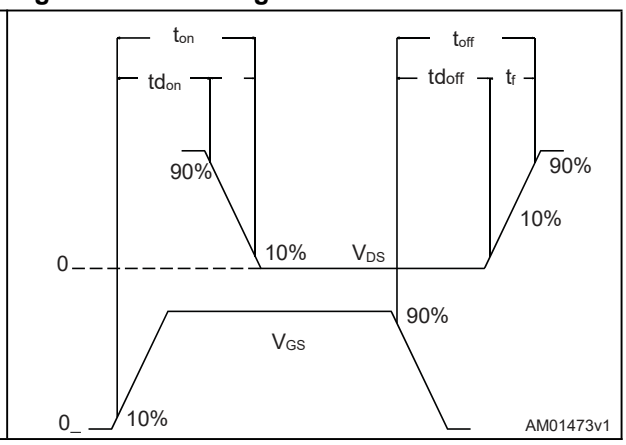


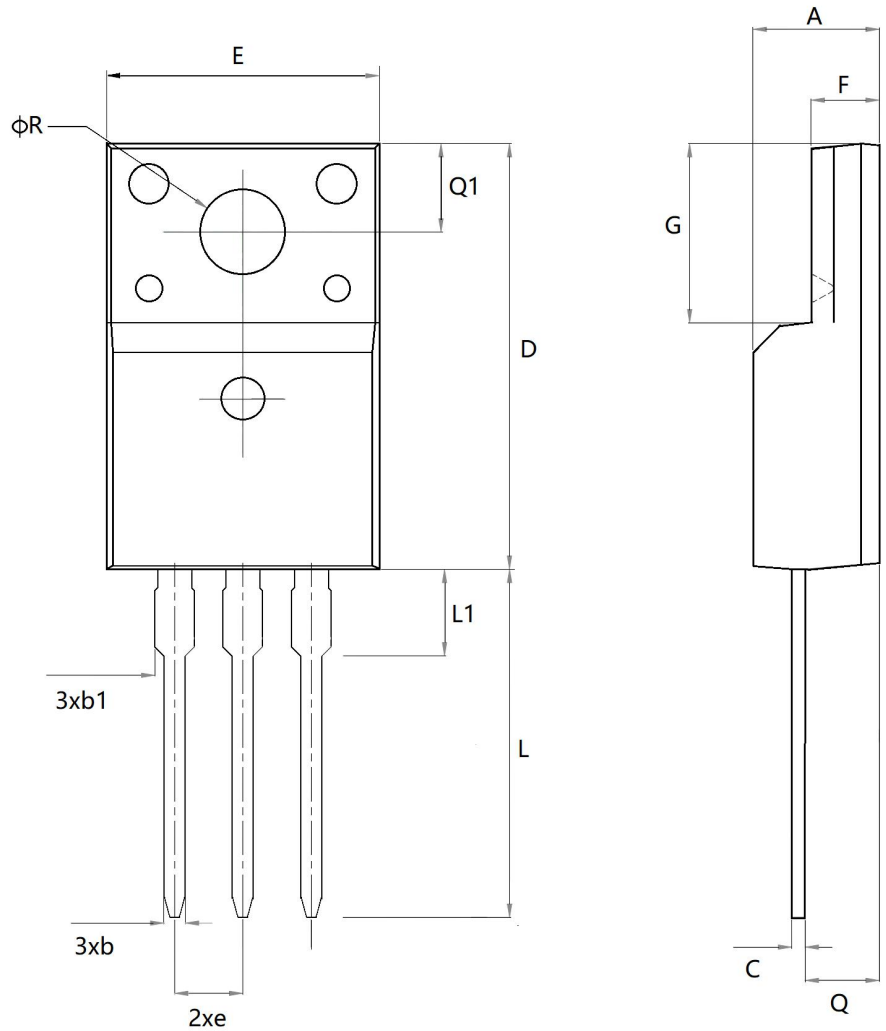
Figure 23. Switching time waveform



4 Package mechanical data

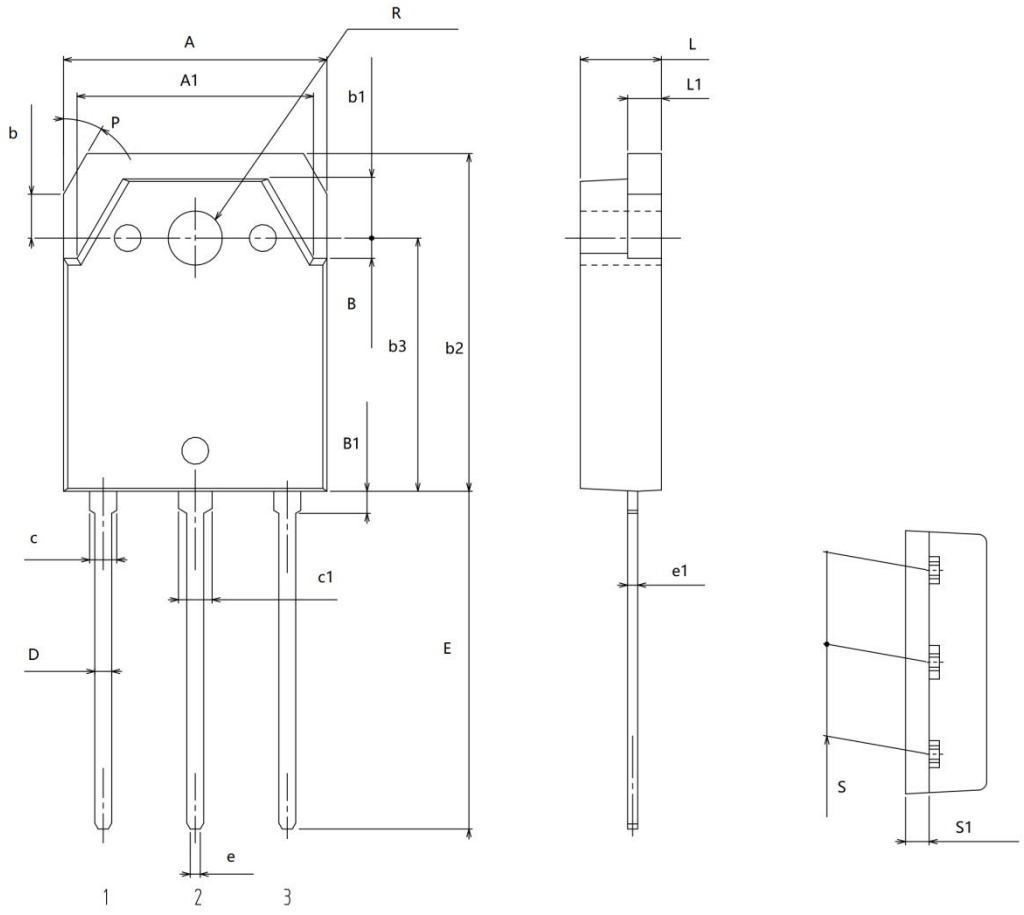
TO-220F mechanical

DIM.	mm.		
	min.	typ	max.
A	4.52		4.82
C	0.45		0.6
D	15.67		15.97
Q1	3.20		3.41
E	10.01		10.36
F	2.34		2.74
L	12.78		13.18
G	6.48		6.88
L1	3.23		3.43
R		3.18	



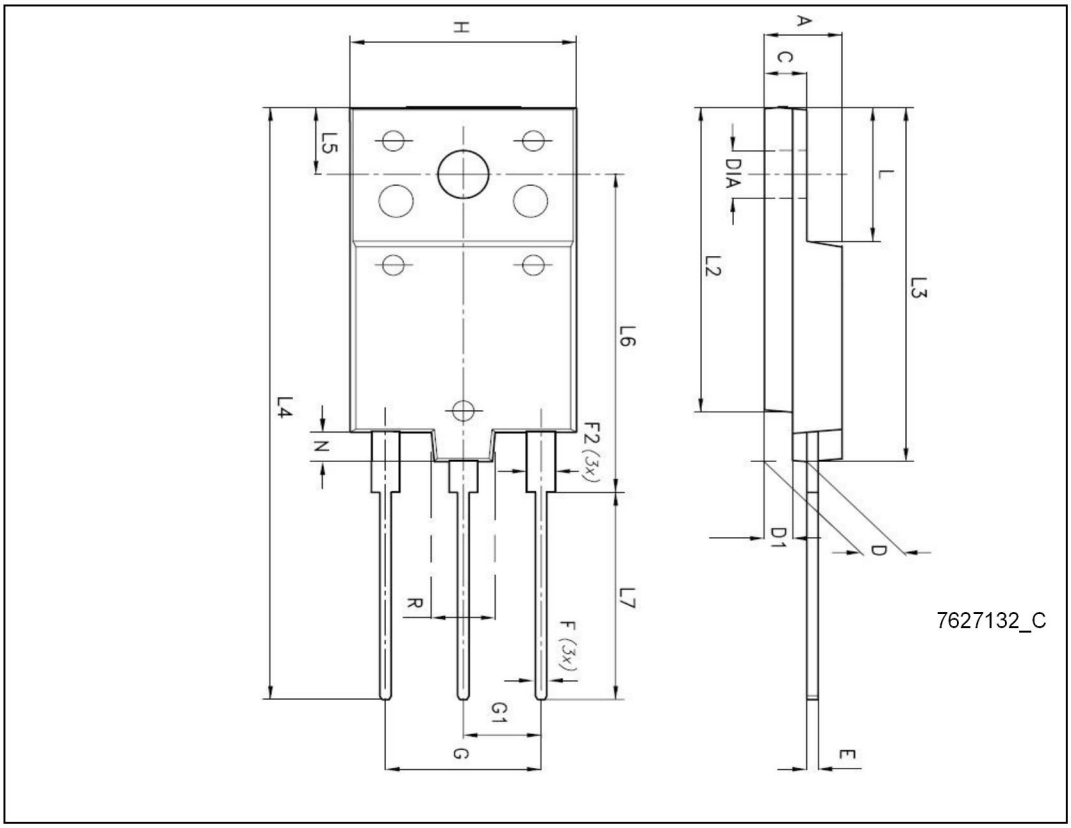
TO-3PB Mechanical data

Dim	mm.		
	Min	Typ	Max
A	15.3	15.6	15.9
A1	13.8	14	14.2
b	2.4	2.6	2.8
b1	3.3	3.5	3.7
b2	19.7	20	20.3
b3	14.7	15	15.3
B	1	0.2	1.4
B1	1	1.3	1.6
c	1.3	1.6	1.9
c1	1.7	2	2.3
D	0.9	1	1.3
E	19.5	20	20.5
e	0.4	0.6	0.8
e1	-	0.6	-
L	4.6	4.8	5
L1	1.8	2	2.2
P		30°	
R	-	3.2	-
S	-	5.45	-
S1	-	1.41	-



TO-3PF mechanical data

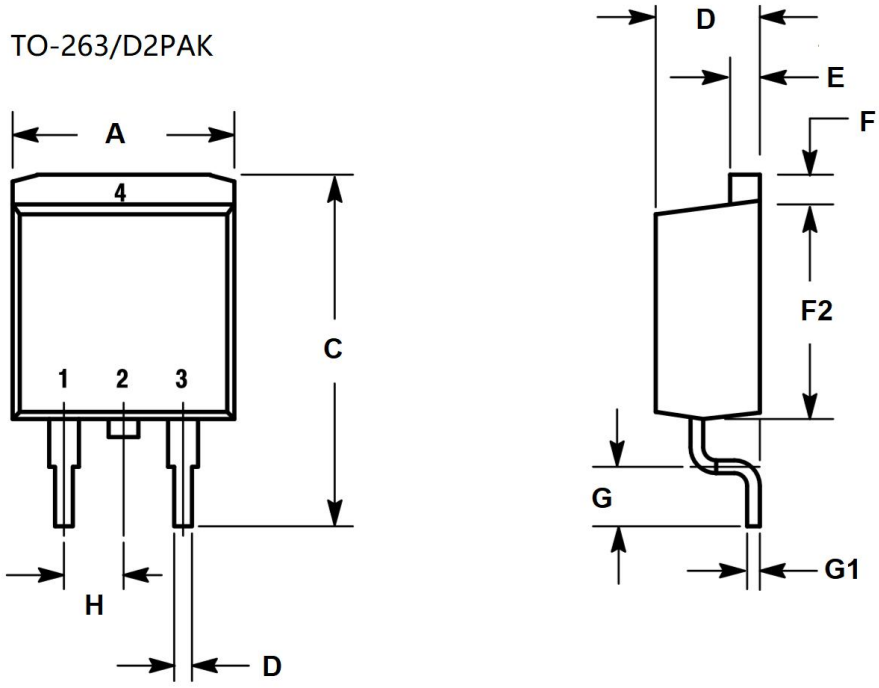
DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80



TO-263 mechanical data

DIM.	mm.		
	min.	typ	max.
A	9.65		10.29
C	14.6		15.88
D	0.51		0.92
D1	4.06		4.83
E	1.14		1.40
F	1.14		1.40
F2	8.64		9.64
G	2.29		2.79
G1	0.46		0.64
H		2.54BSC	

TO-263/D2PAK



TO-247 mechanical data

DIM.	mm.		
	min.	typ	max.
A	4.7		5.31
A1	2.21		2.59
A2	1.5		2.49
b	1		1.4
b2	1.65		2.39
b4	2.59		3.43
c	0.38		0.89
D	20.8		21.46
D1	13.08		-
D2	0.51		1.35
E	15.49		16.26
E1	13.46		-
E2	4.32		5.49
e	5.46BSC		
L	19.81		20.32
L1	-		4.5
P	3.56		3.66
Q	5.38		6.2
S	6.15BSC