



# STP22NS25Z STB22NS25Z

## N-CHANNEL 250V - 0.13Ω - 22A TO-220/D<sup>2</sup>PAK Zener-Protected MESH OVERLAY™ MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP22NS25Z	250 V	< 0.15 Ω	22 A
STB22NS25Z	250 V	< 0.15 Ω	22 A

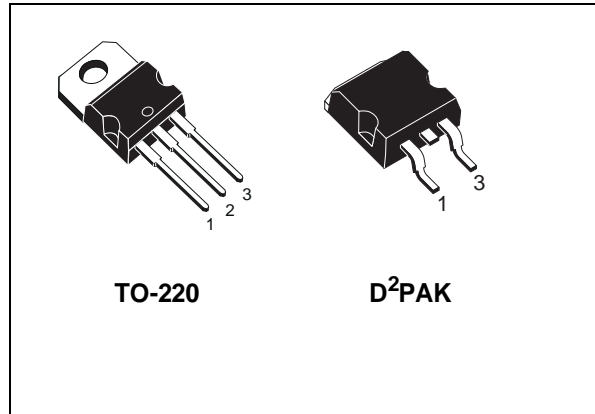
- TYPICAL R<sub>DS(on)</sub> = 0.13 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED

### DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performance. The new patented STRIP layout coupled with the Company's proprietary edge termination structure, makes it suitable in converters for lighting applications.

### APPLICATIONS

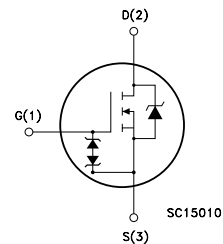
- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-DC CONVERTERS FOR TELECOM, INDUSTRIAL, AND LIGHTING EQUIPMENT



TO-220

D<sup>2</sup>PAK

### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	250	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	250	V
V <sub>GS</sub>	Gate- source Voltage	± 20	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	22	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	13.9	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	88	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	135	W
	Derating Factor	1.07	W/°C
V <sub>ESD(G-S)</sub>	Gate source ESD(HBM-C=100pF, R=1.5KΩ)	2500	V
dv/dt (1)	Peak Diode Recovery voltage slope	5	V/ns
T <sub>stg</sub>	Storage Temperature	-55 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature		

(•)Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 22A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

## STP22NS25Z / STB22NS25Z

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	0.93	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose	300	°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	22	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V, R <sub>g</sub> = 47 Ohm)	350	mJ

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	250			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			10 100	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±18V			±10	μA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2	3	4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 11 A		0.13	0.15	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> , I <sub>D</sub> = 11A		22		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		2400		pF
C <sub>oss</sub>	Output Capacitance			340		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			120		pF

## ELECTRICAL CHARACTERISTICS (CONTINUED)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 125\text{ V}$ , $I_D = 11\text{ A}$ $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3)		20		ns
$t_r$	Rise Time			30		ns
$Q_g$	Total Gate Charge	$V_{DD} = 200\text{ V}$ , $I_D = 20\text{ A}$ , $V_{GS} = 10\text{ V}$		108	151	nC
$Q_{gs}$	Gate-Source Charge			11		nC
$Q_{gd}$	Gate-Drain Charge			40		nC

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(Voff)}$ $t_f$	Turn-off- Delay Time Fall Time	$V_{DD} = 125\text{ V}$ , $I_D = 11\text{ A}$ , $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3)		100 78		ns ns
$t_{r(Voff)}$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time		$V_{clamp} = 200\text{ V}$ , $I_D = 22\text{ A}$ , $R_G = 4.7\Omega$ , $V_{GS} = 10\text{ V}$ (see test circuit, Figure 5)		37 65 110	

## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				22	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				88	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 22\text{ A}$ , $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 22\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$ , $T_J = 150^\circ\text{C}$ (see test circuit, Figure 5)		292		ns
$Q_{rr}$	Reverse Recovery Charge			3065		nC
$I_{RRM}$	Reverse Recovery Current			21		A

## GATE-SOURCE ZENER DIODE

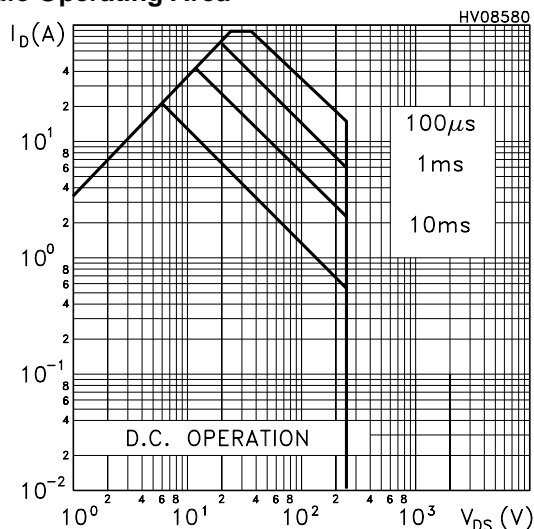
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$BV_{GSO}$	Gate-Source Breakdown Voltage	$I_{GS} = \pm 500\mu\text{A}$ (Open Drain)	20			V

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

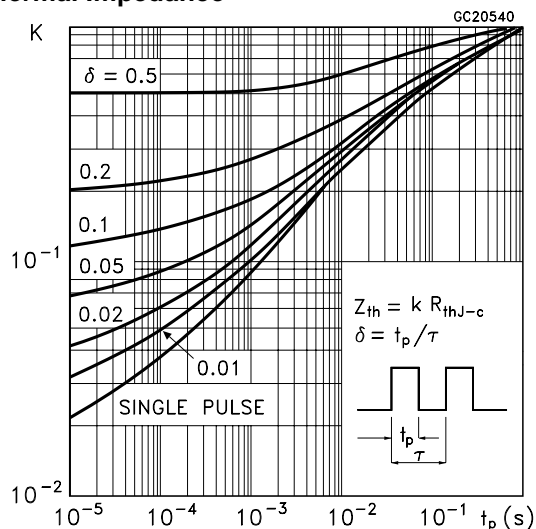
## PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

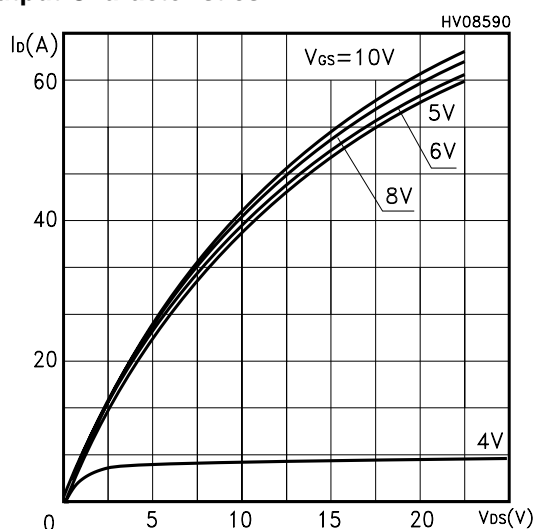
Safe Operating Area



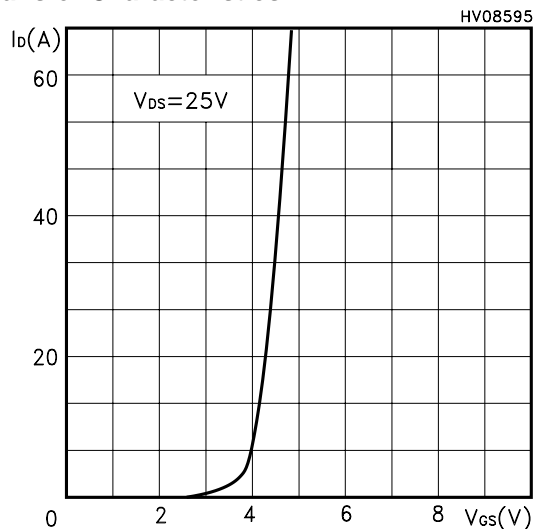
Thermal Impedance



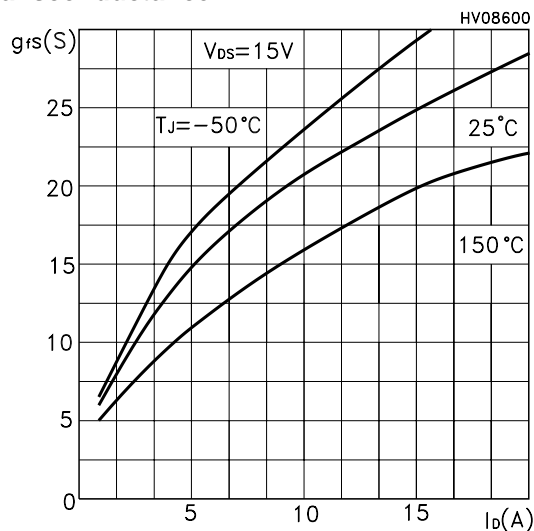
Output Characteristics



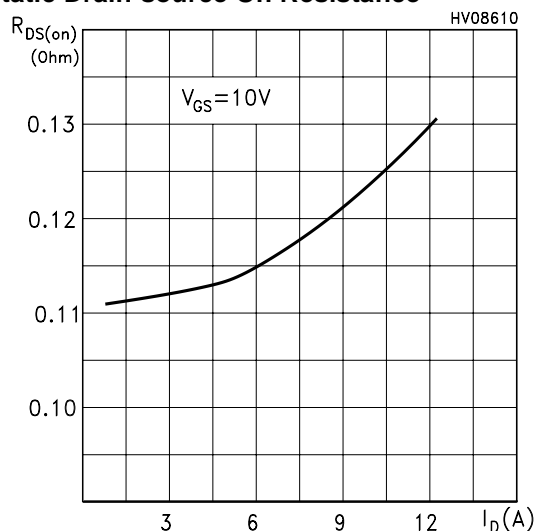
Transfer Characteristics



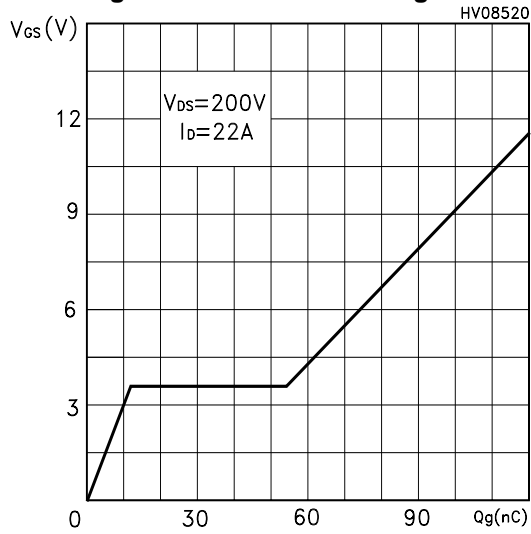
Transconductance



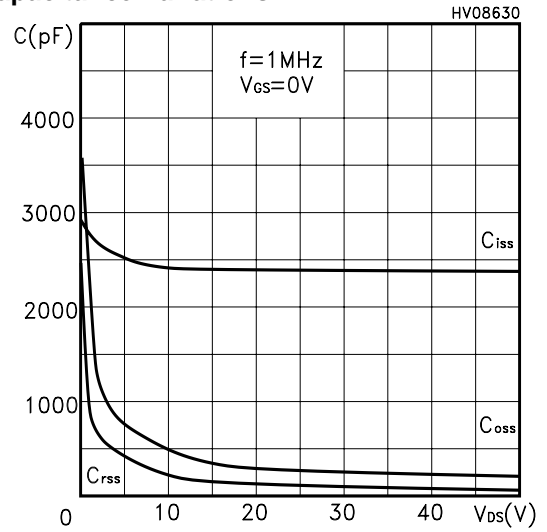
Static Drain-source On Resistance



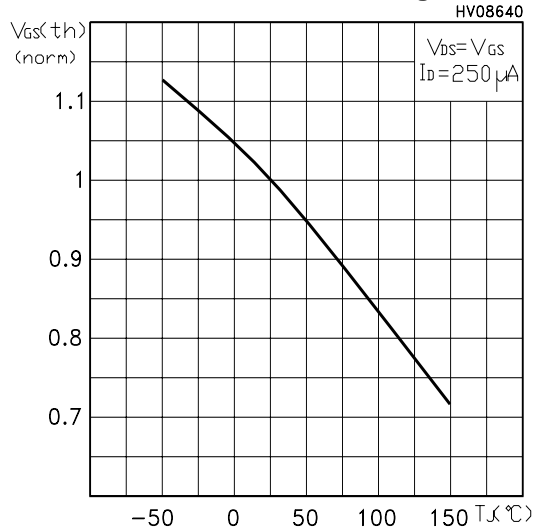
**Gate Charge vs Gate-source Voltage**



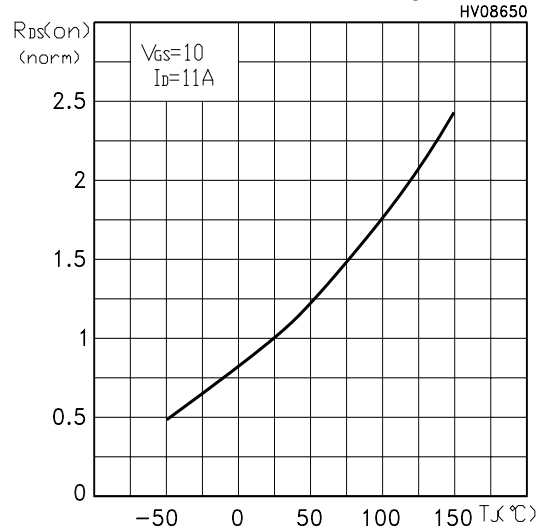
**Capacitance Variations**



**Normalized Gate Threshold Voltage vs Temp.**



**Normalized On Resistance vs Temperature**



**Source-drain Diode Forward Characteristics**

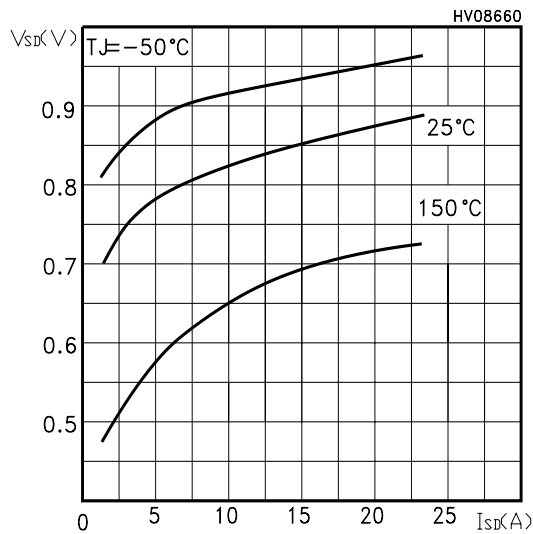


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 4: Gate Charge test Circuit

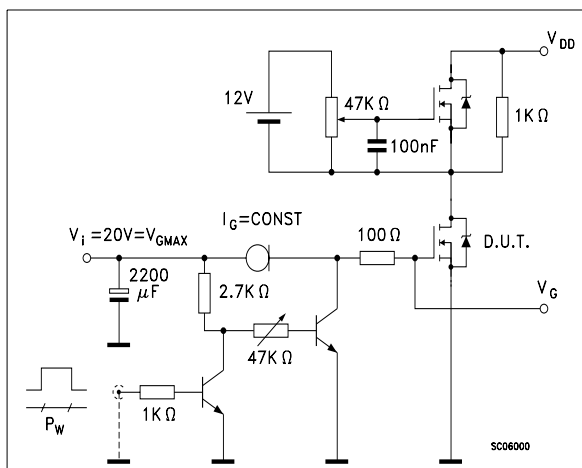
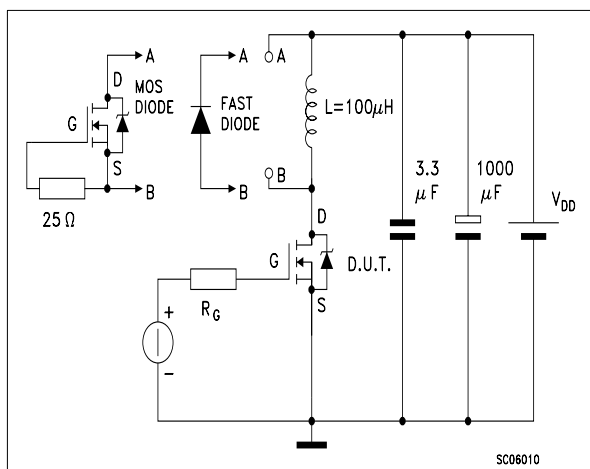
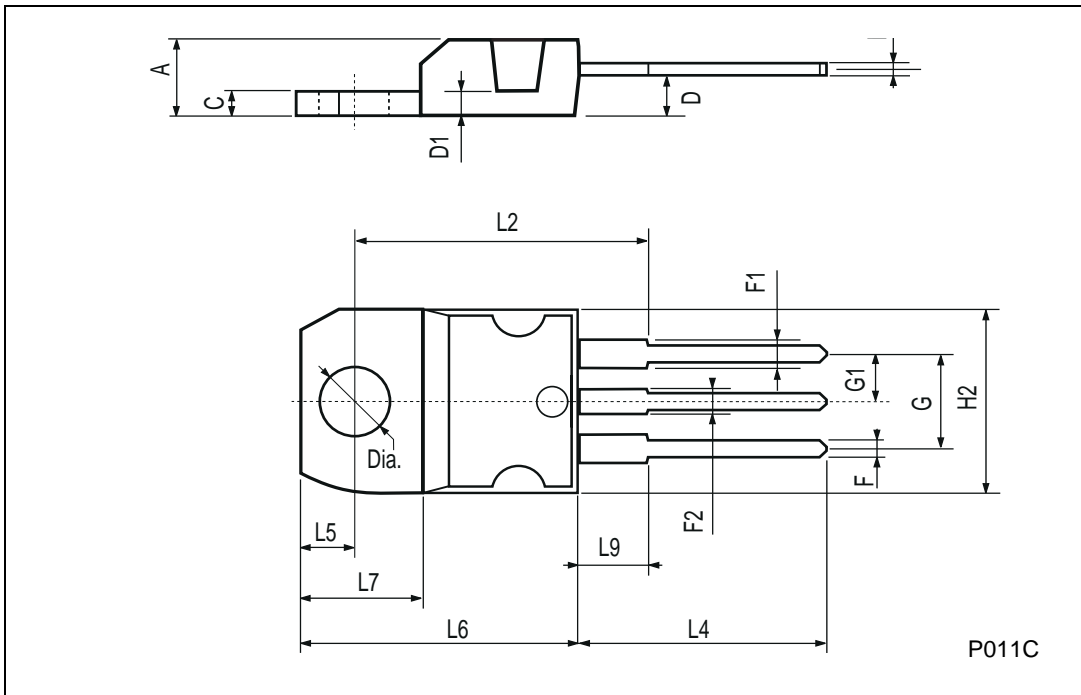


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



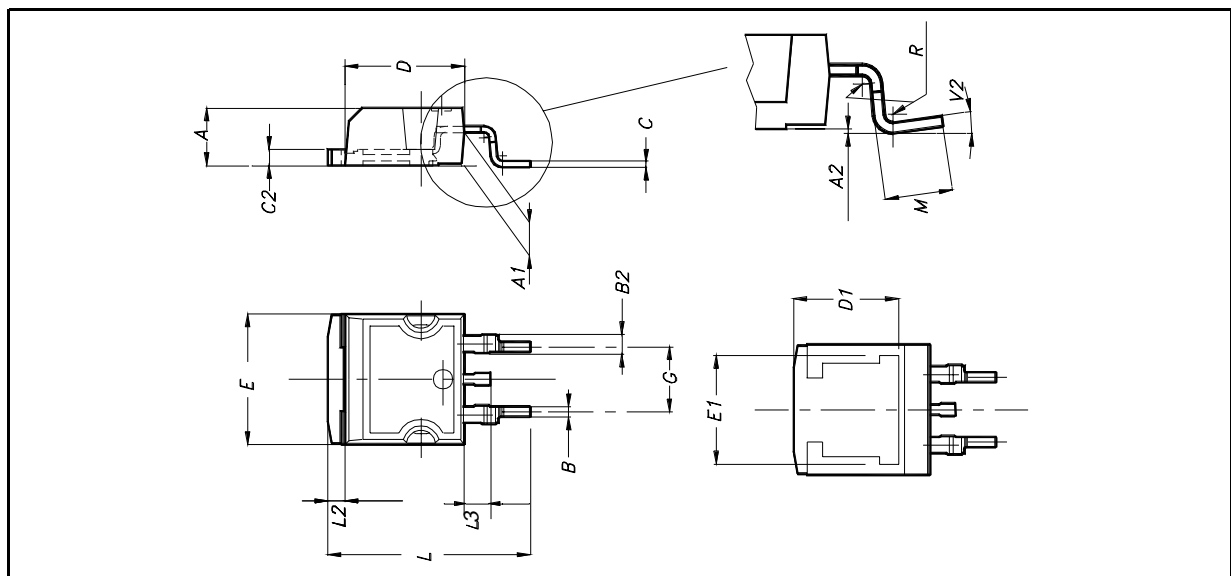
**TO-220 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



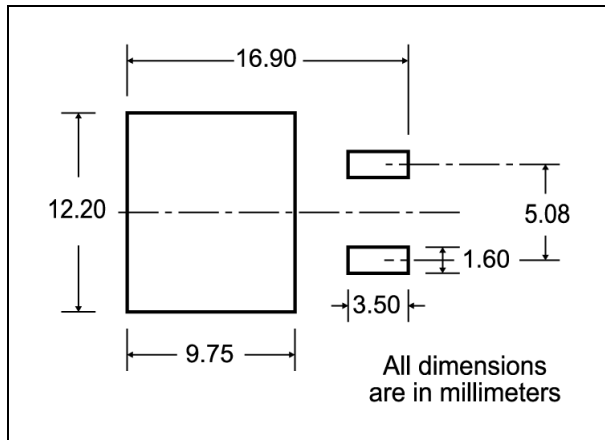
**D<sup>2</sup>PAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			

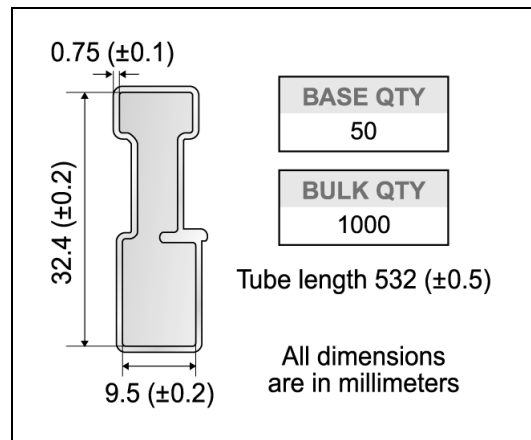




### D<sup>2</sup>PAK FOOTPRINT



### TUBE SHIPMENT (no suffix)\*



### TAPE AND REEL SHIPMENT (suffix "T4")\*

Diagram showing the tape mechanical data. It includes a circular view of the tape with dimensions A, B, C, D, and G. A 40 mm min. access hole is shown at the slot location. The tape slot in the core has a 2.5 mm min. width. The full radius is also indicated. A side view shows dimensions T, N, and G measured at the hub.

#### REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

#### TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

Diagrams showing the tape and reel shipment details. The top diagram shows a cross-section of the tape with dimensions K<sub>0</sub>, T, D, P<sub>2</sub>, P<sub>0</sub>, E, F, W, B<sub>0</sub>, D<sub>1</sub>, A<sub>0</sub>, P<sub>1</sub>, and the center line of the cavity. A note indicates a 10-pitch cumulative tolerance on the tape of ±0.2 mm. The bottom diagram shows the reel with dimensions TRL, FEED DIRECTION, and a bending radius of R min.

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