



# STGP7NB60KD STGB7NB60KD STGP7NB60KDFP

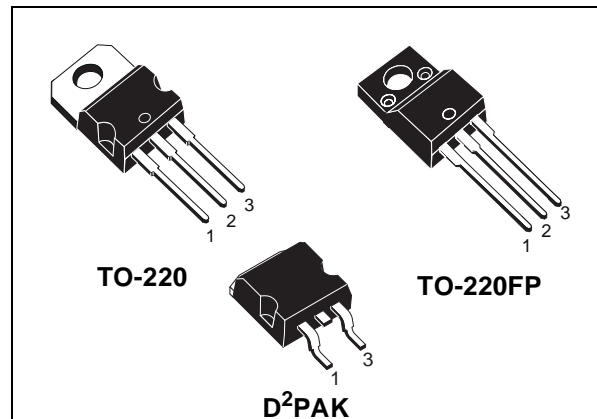
N-CHANNEL 7A - 600V - TO-220/TO-220FP/D<sup>2</sup>PAK

PowerMESH™ IGBT

## ADVANCED DATA

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP7NB60KD	600 V	< 2.8 V	7 A
STGP7NB60KDFP	600 V	< 2.8 V	7 A
STGB7NB60KD	600 V	< 2.8 V	7 A

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

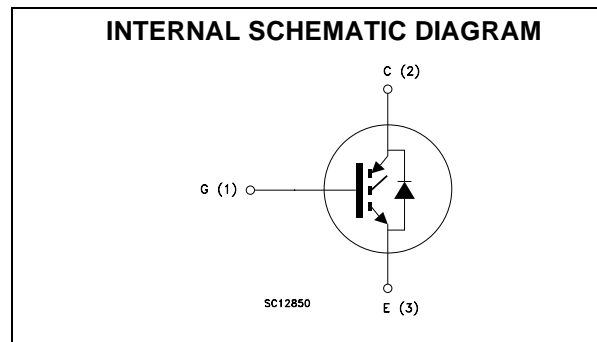


## DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

## APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STGP7NB60KD STGB7NB60KD	STGP7NB60KDFP	
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600		V
V <sub>ECR</sub>	Emitter-Collector Voltage	20		V
V <sub>GE</sub>	Gate-Emitter Voltage	±20		V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 25°C	14		A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 125°C	7		A
I <sub>CM</sub> (■)	Collector Current (pulsed)	56		A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	80	35	W
	Derating Factor	0.64	0.28	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage A.C. (t = 1 sec; T <sub>c</sub> = 25°C)	--	2500	V
T <sub>stg</sub>	Storage Temperature	-65 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(■) Pulse width limited by safe operating area

## STGP7NB60KD/FP/STGB7NB60KD

### THERMAL DATA

		TO-220 D <sup>2</sup> PAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	1.56	3.57	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		°C/W
Rthc-h	Thermal Resistance Case-heatsink Typ	0.5		°C/W

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 250 μA, V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 25 °C V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 125 °C			50 500	μA μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ±20V, V <sub>CE</sub> = 0			±100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA	5		7	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A, T <sub>C</sub> = 100°C		2.3 1.9	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V, I <sub>C</sub> = 7 A		5		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		560		pF
C <sub>oes</sub>	Output Capacitance			68		pF
C <sub>res</sub>	Reverse Transfer Capacitance			15		pF
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 480V, I <sub>C</sub> = 7 A, V <sub>GE</sub> = 15V		42		nC
Q <sub>ge</sub>	Gate-Emitter Charge			7.9		nC
Q <sub>gc</sub>	Gate-Collector Charge			17.6		nC
t <sub>scw</sub>	Short Circuit Withstand Time	V <sub>ce</sub> = 0.5 V <sub>BR(CES)</sub> , V <sub>GE</sub> = 15 V, T <sub>j</sub> = 125°C, R <sub>G</sub> = 10 Ω	10			μs

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 7 A R <sub>G</sub> = 10Ω, V <sub>GE</sub> = 15 V		15		ns
t <sub>r</sub>	Rise Time			48		ns
(di/dt) <sub>on</sub>	Turn-on Current Slope	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 7 A R <sub>G</sub> = 10Ω V <sub>GE</sub> = 15 V, T <sub>j</sub> = 125°C		160		A/μs
E <sub>on</sub>	Turn-on Switching Losses			70		μJ

**ELECTRICAL CHARACTERISTICS (CONTINUED)****SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		85		ns
$t_r(V_{off})$	Off Voltage Rise Time			20		ns
$t_{d(off)}$	Delay Time			75		ns
$t_f$	Fall Time			70		ns
$E_{off(**)}$	Turn-off Switching Loss			85		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			235		$\mu\text{J}$
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_j = 125 \text{ }^\circ\text{C}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time			50		ns
$t_{d(off)}$	Delay Time			110		ns
$t_f$	Fall Time			110		ns
$E_{off(**)}$	Turn-off Switching Loss			220		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			405		$\mu\text{J}$

**COLLECTOR-EMITTER DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				6	A
$I_{fm}$	Forward Current pulsed				48	A
$V_f$	Forward On-Voltage	$I_f = 6 \text{ A}$ $I_f = 6 \text{ A}$ , $T_j = 125 \text{ }^\circ\text{C}$		1.8	2.2	V
				1.4		V
$t_{rr}$	Reverse Recovery Time	$I_f = 6 \text{ A}$ , $V_R = 200 \text{ V}$ , $T_j = 125 \text{ }^\circ\text{C}$ , $di/dt = 100 \text{ A}/\mu\text{s}$		100		ns
$Q_{rr}$	Reverse Recovery Charge			135		nC
$I_{rrm}$	Reverse Recovery Current			2.7		A

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*)Losses include Also the Tail (Jedec Standardization)

Fig. 1: Gate Charge test Circuit

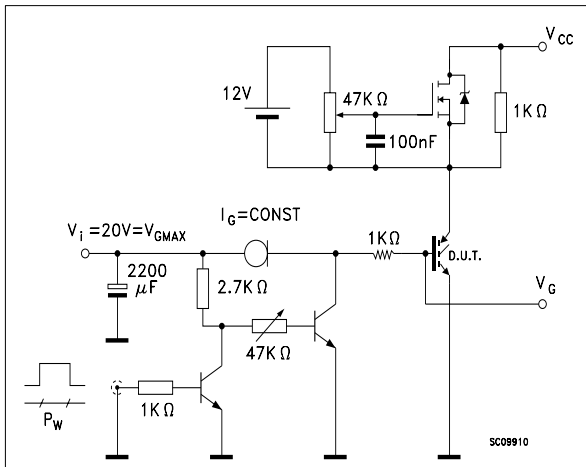
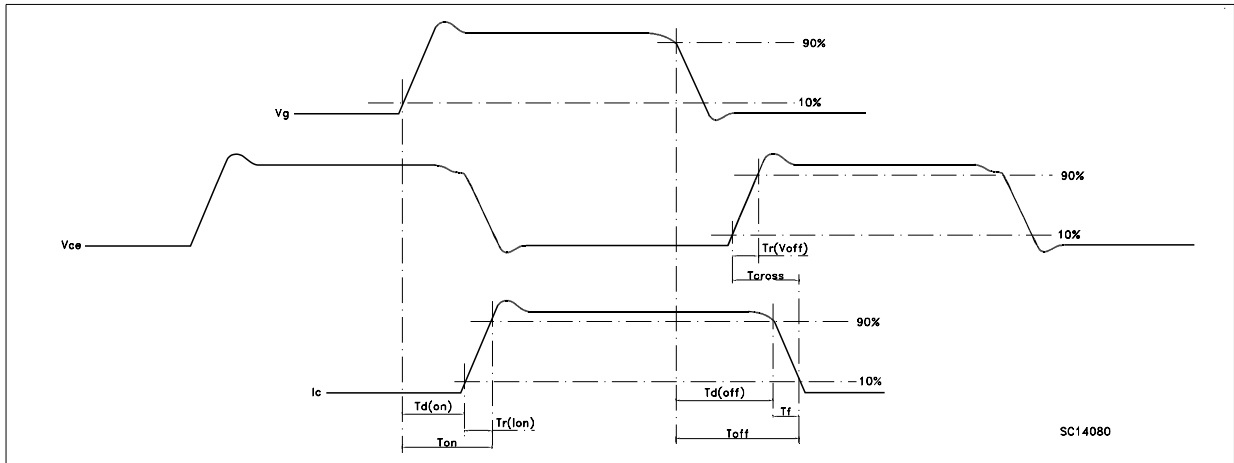
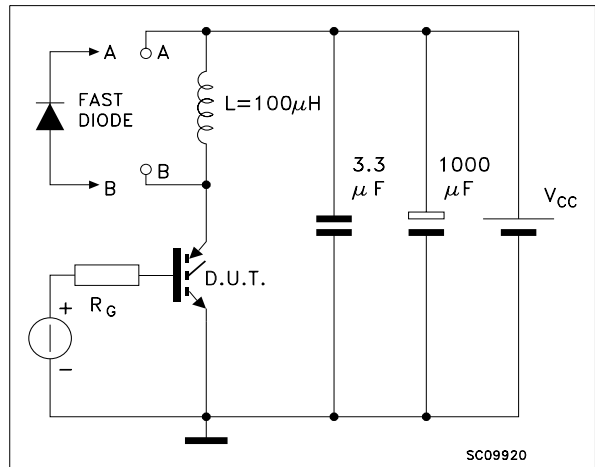
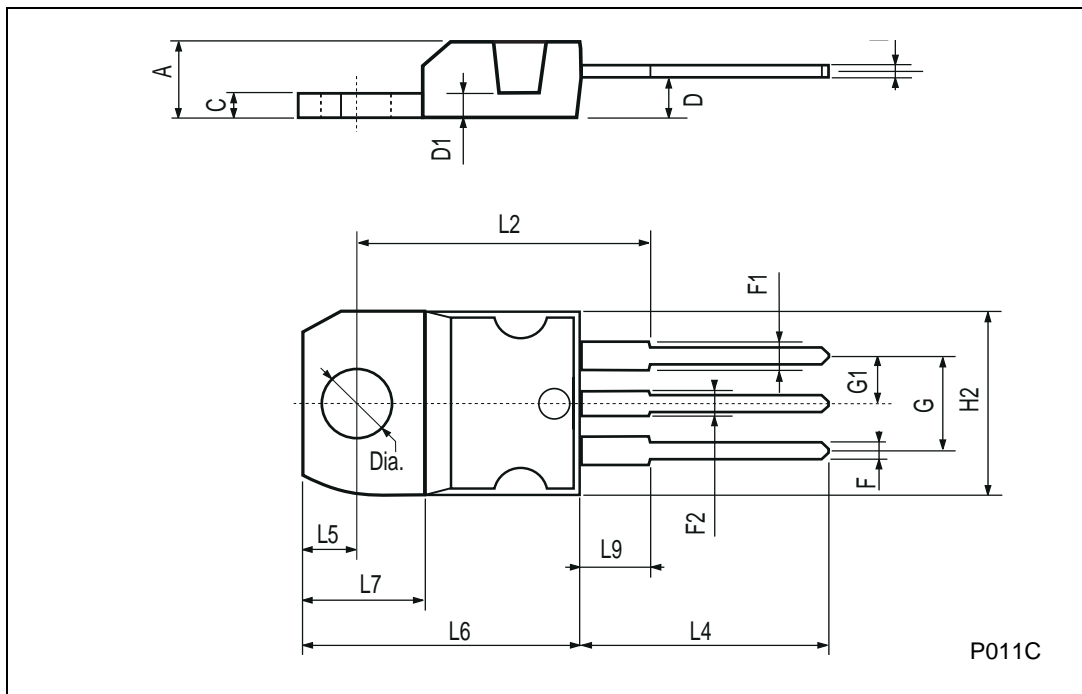


Fig. 2: Test Circuit For Inductive Load Switching



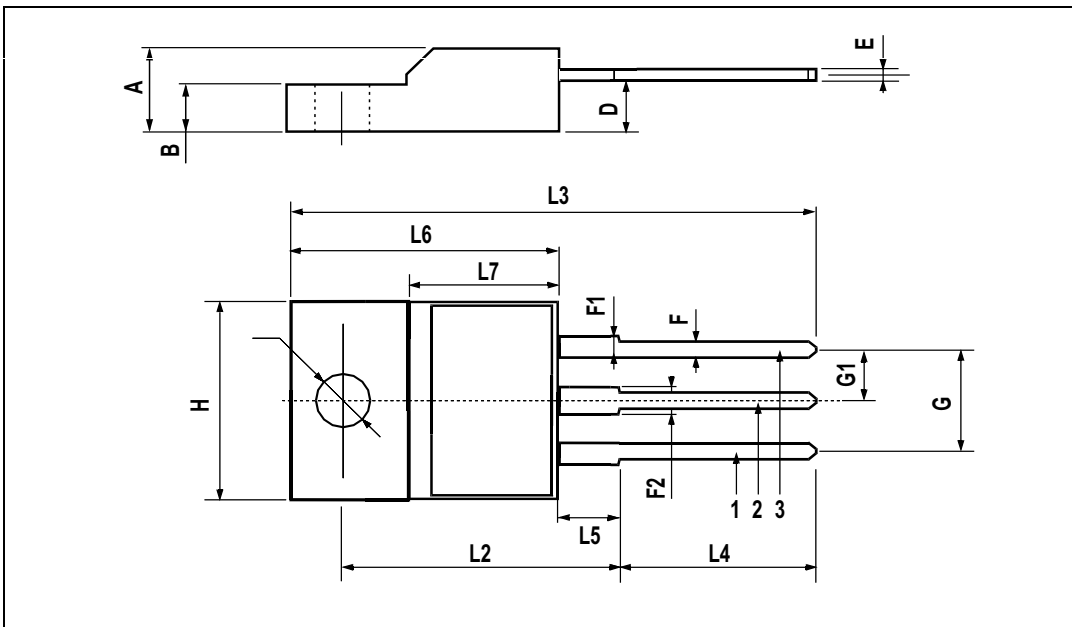
TO-220 MECHANICAL DATA

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



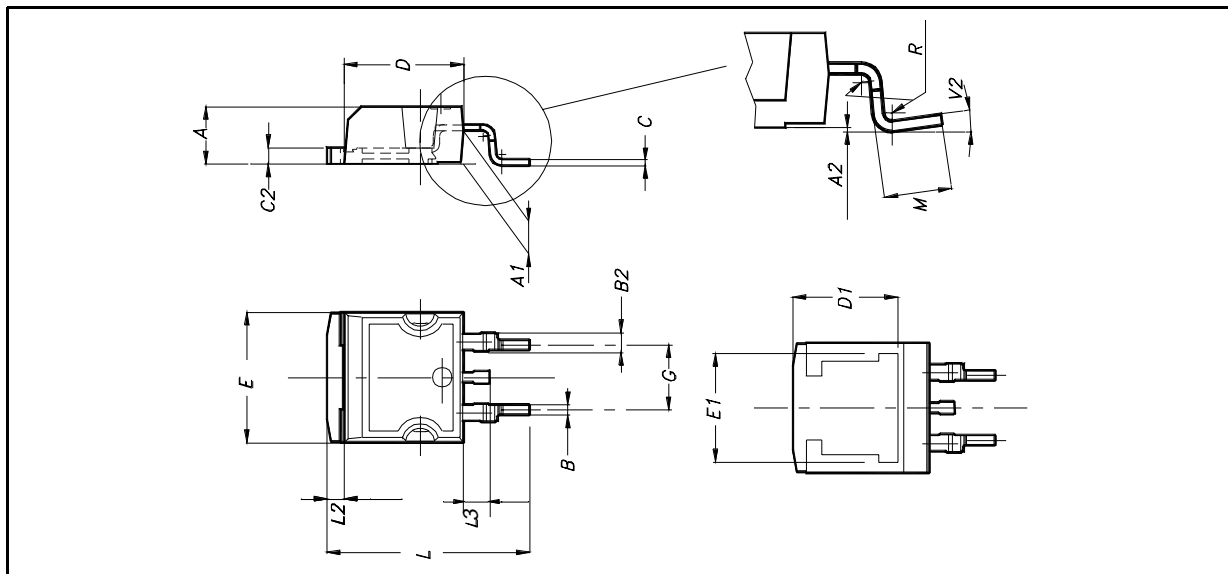
**TO-220FP MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126

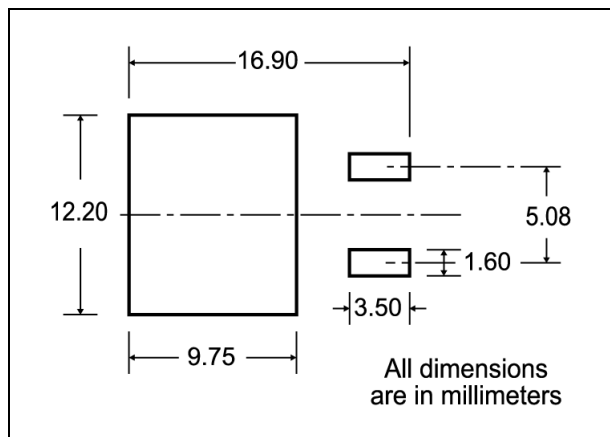


D<sup>2</sup>PAK MECHANICAL DATA

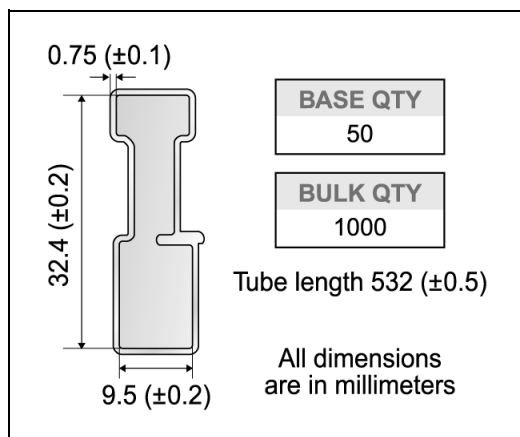
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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 reel view with dimensions A (radius), B (slot width), C (slot depth), D (slot width), and D1 (slot width). A note indicates a 40 mm min. access hole at the slot location. Another note indicates a tape slot in the core for tape start with a 2.5 mm min. width. A side view shows dimensions T (thickness), C (width), N (width), and G (width 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. The top diagram shows a top view of the tape with dimensions K<sub>0</sub>, 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 Center line of cavity. A note indicates a 10 pitches cumulative tolerance on tape of +/- 0.2 mm. The bottom diagram shows a side view of the tape with dimensions TRL, FEED DIRECTION, and Bending radius R min.

\* on sales type



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