Two Pair, N- and P-Channel Enhancement-Mode MOSFET

Features

► High voltage Vertical DMOS technology
► Integrated gate-to-source resistor
► Integrated gate-to-source Zener diode
► Low threshold, Low on-resistance
► Low input & output capacitance
► Fast switching speeds
► Electrically isolated N- and P-MOSFET pairs

Applications

► High voltage pulsers
► Amplifiers
► Buffers
► Piezoelectric transducer drivers
► General purpose line drivers
► Logic level interfaces

General Description

The Supertex TC8220 consists of two pairs of high voltage, low threshold N-channel and P-channel MOSFETs in a 12-Lead DFN package. All MOSFETs have integrated the gate-to-source resistors and gate-to-source Zener diode clamps which are desired for high voltage pulser applications. The complimentary, high-speed, high voltage, gate-clamped N and P-channel MOSFET pairs utilize an advanced vertical DMOS structure and Supertex's well-proven silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and with the high input impedance and positive temperature coefficient inherent in MOS devices.

Characteristic of all MOS structures, these devices are free from thermal runaway and thermally induced secondary breakdown. Supertex's vertical DMOS FETs are ideally suited to a wide range of switching and amplifying applications where very low threshold voltage, high breakdown voltage, high input impedance, low input and output capacitance, and fast switching speeds are desired.

Typical Application Circuit
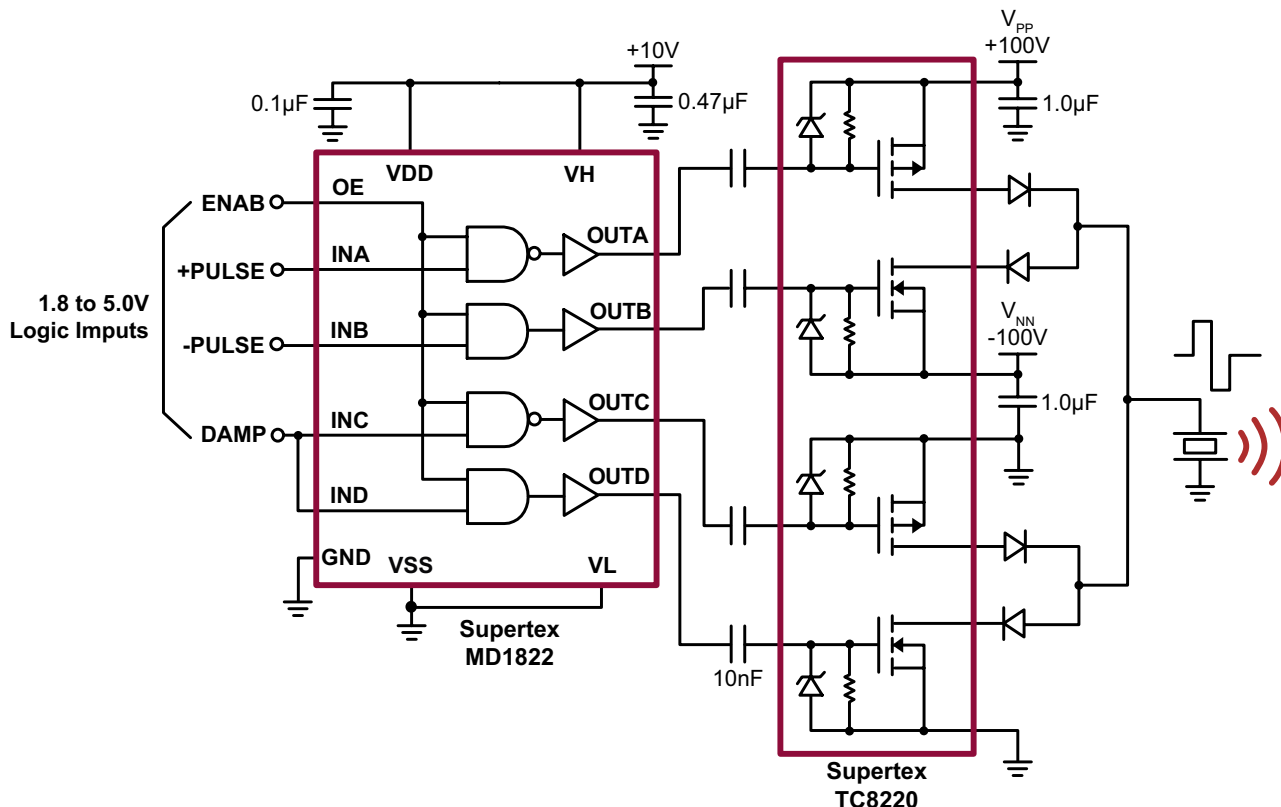
Ordering Information

Part Number	Package Option	Packing
TC8220K6-G	12-Lead DFN (4x4)	3000/Reel

-G denotes a lead (Pb)-free / RoHS compliant package

Product Summary

BV_{DSS}/BV_{DGS}		$R_{DS(ON)}$ (max)	
N-Channel	P-Channel	N-Channel	P-Channel
200V	-200V	5.3Ω	6.5Ω

Absolute Maximum Ratings

Parameter	Value
Drain-to-source voltage	BV_{DSS}
Drain-to-gate voltage	BV_{DGS}
Operating and storage temperature	-55°C to +150°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

Pin Configuration

GN1	1		12	SN1
GP1	2	Thermal Pad	11	DN1
GN2	3		10	DP1
SN2	4		9	SP1
GP2	5		8	DN2
SP2	6		7	DP2
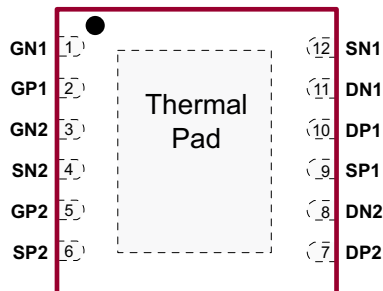
12-Lead DFN
(top view)

Typical Thermal Resistance

Package	θ_{ja}
12-Lead DFN	42°C/W

Note:
1.0oz, 4-layer, 3"x4" PCB.

Package Marking

8220
YWLL

Y = Last Digit of Year Sealed
W = Code for Week Sealed
L = Lot Number
___ = "Green" Packaging

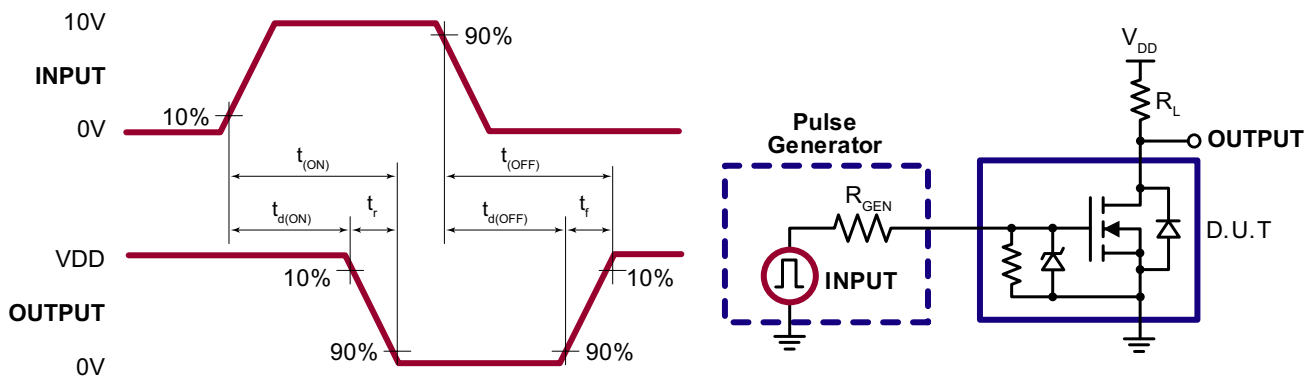*Package may or may not include the following marks: Si or*

12-Lead DFN

N-Channel Electrical Characteristics *(T_A = 25°C unless otherwise specified)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
BV_{DSS}	Drain-to-source breakdown voltage	200	-	-	V	V_{GS} = 0V, I_D = 2.0mA
$V_{GS(th)}$	Gate threshold voltage	1.0	-	2.4	V	V_{GS} = V_{DS}, I_D = 1.0mA
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-	-4.5	mV/°C	V_{GS} = V_{DS}, I_D = 1.0mA
R_{GS}	Gate-to-source shunt resistor	10	-	50	KΩ	I_{GS} = 100µA
VZ_{GS}	Gate-to-source Zener voltage	13.2	-	25	V	I_{GS} = 2.0mA
I_{DSS}	Zero gate voltage drain current	-	-	10.0	µA	V_{DS} = Max rating, V_{GS} = 0V
		-	-	1.0	mA	V_{DS} = 0.8 Max Rating, V_{GS} = 0V, T_A = 125°C
$I_{D(ON)}$	On-state drain current	1.3	-	-	A	V_{GS} = 5.0V, V_{DS} = 25V
		2.3	-	-		V_{GS} = 10V, V_{DS} = 50V
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	-	6.5	Ω	V_{GS} = 5.0V, I_D = 150mA
		-	-	6.0		V_{GS} = 10V, I_D = 1.0A
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	-	1.0	%/°C	V_{GS} = 10V, I_D =1.0A
G_{FS}	Forward transconductance	400	-	-	mmho	V_{DS} = 25V, I_D = 500mA
C_{ISS}	Input capacitance	-	56	-	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz
C_{OSS}	Common source output capacitance	-	13	-		
C_{RSS}	Reverse transfer capacitance	-	2.0	-		
$t_{d(ON)}$	Turn-on delay time	-	-	10	ns	V_{DD} =25V, I_D = 1.0A, R_{GEN} = 25Ω
t_r	Rise time	-	-	15		
$t_{d(OFF)}$	Turn-off delay time	-	-	20		
t_f	Fall time	-	-	15		
V_{SD}	Diode forward voltage drop	-	-	1.8	V	V_{GS} = 0V, I_{SD} = 500mA
t_{rr}	Reverse recovery time	-	300	-	ns	V_{GS} = 0V, I_{SD} = 500mA

Notes:
1. *All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)*
2. *All A.C. parameters sample tested.*

N-Channel Switching Waveforms and Test Circuit

P-Channel Electrical Characteristics *(T$_A$ = 25°C unless otherwise specified)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
BV$_{DSS}$	Drain-to-source breakdown voltage	-200	-	-	V	V$_{GS}$ = 0V, I$_D$ = -2.0mA
V$_{GS(th)}$	Gate threshold voltage	-1.0	-	-2.4	V	V$_{GS}$ = V$_{DS}$, I$_D$ = -1.0mA
ΔV$_{GS(th)}$	Change in V$_{GS(th)}$ with temperature	-	-	4.5	mV/°C	V$_{GS}$ = V$_{DS}$, I$_D$ = -1.0mA
R$_{GS}$	Gate-to-source shunt resistor	10	-	50	KΩ	I$_{GS}$ = 100µA
VZ$_{GS}$	Gate-to-source Zener voltage	13.2	-	25	V	I$_{GS}$ = -2.0mA
I$_{DSS}$	Zero gate voltage drain current	-	-	-10	µA	V$_{DS}$ = Max rating, V$_{GS}$ = 0V
		-	-	-1.0	mA	V$_{DS}$ = 0.8 Max Rating, V$_{GS}$ = 0V, T$_A$ = 125°C
I$_{D(ON)}$	On-state drain current	-1.2	-	-	A	V$_{GS}$ = -5.0V, V$_{DS}$ = -25V
		-2.3	-	-		V$_{GS}$ = -10V, V$_{DS}$ = -50V
R$_{DS(ON)}$	Static drain-to-source on-state resistance	-	-	8.5	Ω	V$_{GS}$ = -5.0V, I$_D$ = -150mA
		-	-	7.0		V$_{GS}$ = -10V, I$_D$ = -1.0A
ΔR$_{DS(ON)}$	Change in R$_{DS(ON)}$ with temperature	-	-	1.0	%/°C	V$_{GS}$ = -10V, I$_D$ = -1.0A
G$_{FS}$	Forward transconductance	400	-	-	mmho	V$_{DS}$ = -25V, I$_D$ = -500mA
C$_{ISS}$	Input capacitance	-	75	-	pF	V$_{GS}$ = 0V, V$_{DS}$ = -25V, f = 1.0MHz
C$_{OSS}$	Common source output capacitance	-	21	-		
C$_{RSS}$	Reverse transfer capacitance	-	6.5	-		
t$_{d(ON)}$	Turn-on delay time	-	-	10	ns	V$_{DD}$ = -25V, I$_D$ = -1.0A, R$_{GEN}$ = 25Ω
t$_r$	Rise time	-	-	15		
t$_{d(OFF)}$	Turn-off delay time	-	-	20		
t$_f$	Fall time	-	-	15		
V$_{SD}$	Diode forward voltage drop	-	-	-1.8	V	V$_{GS}$ = 0V, I$_{SD}$ = -500mA
t$_{rr}$	Reverse recovery time	-	300	-	ns	V$_{GS}$ = 0V, I$_{SD}$ = -500mA

Notes:
1. *All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)*
2. *All A.C. parameters sample tested.*

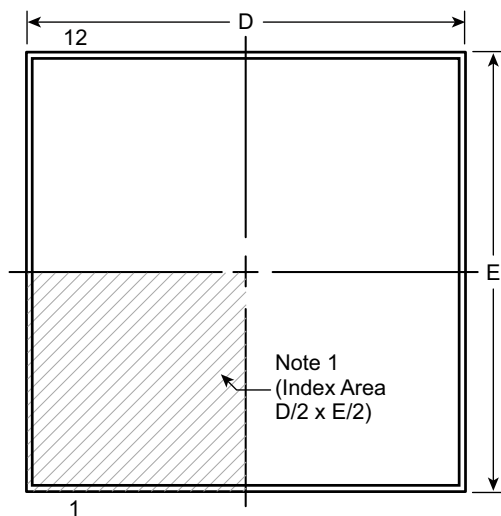## P-Channel Switching Waveforms and Test Circuit
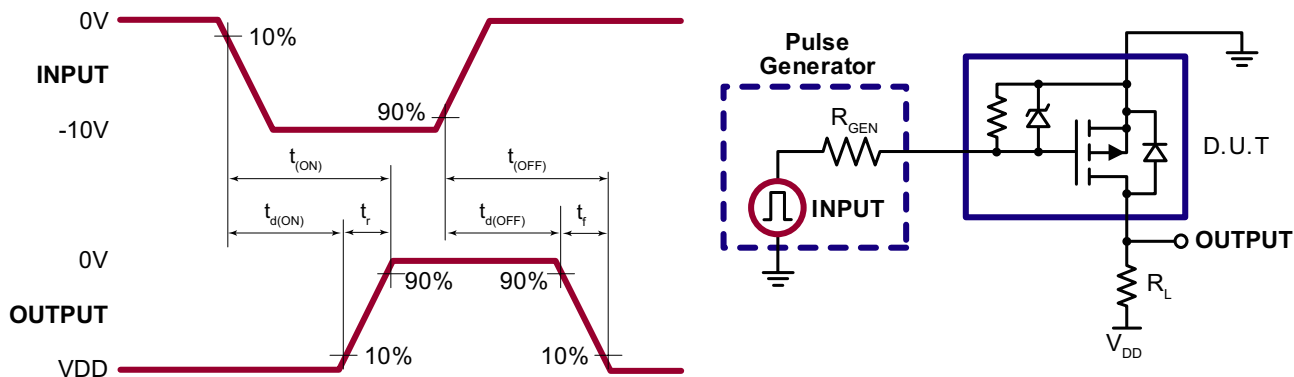
Pin Description

Pin #	Function	Description	Pin #	Function	Description
1	GN1	Gate of N-MOSFET 1	7	DP2	Drain of P-MOSFET 2
2	GP1	Gate of P-MOSFET 1	8	DN2	Drain of N-MOSFET 2
3	GN2	Gate of N-MOSFET 2	9	SP1	Source of P-MOSFET 1
4	SN2	Source of N-MOSFET 2	10	DP1	Drain of P-MOSFET 1
5	GP2	Gate of P-MOSFET 2	11	DN1	Drain of N-MOSFET 1
6	SP2	Source of P-MOSFET 2	12	SN1	Source of N-MOSFET 1
Thermal Pad		Die attachment substrate, must be grounded externally			

Note:
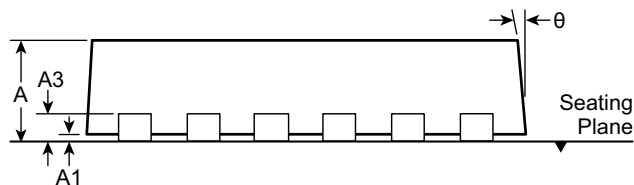 *Thermal Pad must be grounded.*

12-Lead DFN Package Outline (K6)
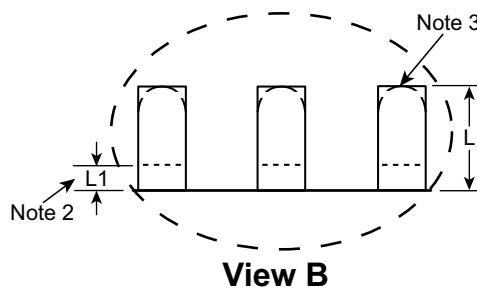## *4.00x4.00mm body, 1.00mm height (max), 0.50mm pitch*

Top View

Note 1
(Index Area
D/2 x E/2)

Bottom View

View B

Note 1
(Index Area
D/2 x E/2)

Side View

Seating
Plane

View B

Note 3
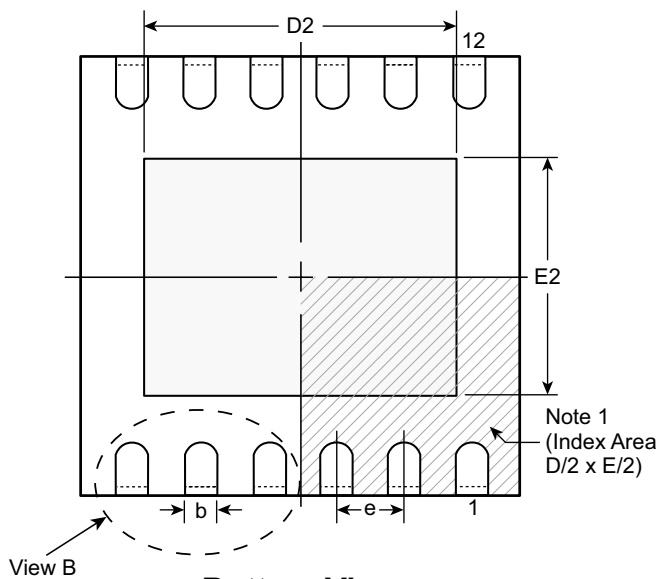
Notes:

1.   A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.
2.   Depending on the method of manufacturing, a maximum of 0.15mm pullback (L1) may be present.
3.   The inner tip of the lead may be either rounded or square.

Symbol		A	A1	A3	b	D	D2	E	E2	e	L	L1	θ
Dimension (mm)	MIN	0.80	0.00	0.20 REF	0.18	3.85	3.19	3.85	2.29	0.50 BSC	0.30	0.00	0°
	NOM	0.90	0.02		0.25	4.00	3.34	4.00	2.44		0.40	-	-
	MAX	1.00	0.05		0.30	4.15	3.44	4.15	2.54		0.50	0.15	14°

Drawings not to scale.
Supertex Doc.#: *DSPD-12DFNK64X4P050, Version A030210.*

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to http://www.supertex.com/packaging.html.)

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