

|                |   |
|----------------|---|
| Structure      | Silicon Monolithic Integrated Circuit   |
| Product Series | 4ch Sensorless System Motor Driver for MD   |
| Type           | <b>BD6640KVT</b>  |
| Features       | <ul style="list-style-type: none"> <li>• Operates at low power supply voltage (2.1V min)</li> <li>• Power DMOS output with low ON resistance (0.8Ω Typ.)</li> <li>• Incorporates a charge pump circuit for VG boost.</li> <li>• 3-phase full-wave soft-switching sensorless driver for spindle</li> <li>• 3-value control 3-phase driver for sled (built-in comparator for BEMF voltage detection)</li> <li>• 2ch, 3-value control H-bridges for focus/tracking</li> <li>• PWM half-bridge for spindle VM power supply</li> </ul> |

○Absolute maximum ratings(Ta=25°C)

| Parameter                                 | Symbol | Limit    | Unit |
|---|--------|----------|------|
| Power supply voltage for control circuit  | VCC    | 7        | V    |
| Power supply voltage for driver block     | VM     | 7        | V    |
| Power supply voltage for pre-driver block | VG     | 14       | V    |
| Input voltage                             | VIN    | 0~VCC    | V    |
| Output current                            | Iomax  | *500     | mA   |
| Power dissipation                         | Pd     | **1250   | mW   |
| Operating temperature range               | Topr   | -25~+75  | °C   |
| Storage temperature range                 | Tstg   | -55~+150 | °C   |
| Junction temperature                      | Tjmax  | +150     | °C   |

\* Must not exceed Pd or ASO, Tjmax=150°C.

\* \* Reduced by 10mW/°C over Ta=25°C, when mounted on a glass epoxy board (70mm×70 mm×1.6mm).

○Operating conditions (Ta=-25~+75°C)

| Parameter             | Symbol | Min. | Typ. | Max | Unit |
|-----------------------|--------|------|------|-----|------|
| Power supply voltage  | VCC1,2 | 2.1  | 2.2  | 6.5 | V    |
|                       | VM     | -    | -    | 5.0 | V    |
|                       | VG     | 3    | 6.5  | 13  | V    |
| Pulse input frequency | fin    | -    | -    | 500 | kHz  |

This product described in this specification is not judged whether it applies to COCOM regulations.

Please confirm in case of export.

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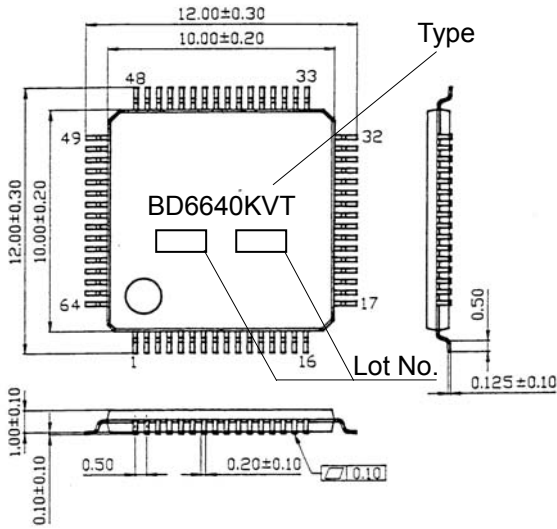
## ○Electrical characteristics

(Unless otherwise specified, Ta=25°C, VCC1, 2=2.2V, VM=1.0V, fin=176kHz)

| Parameter  | Symbol | Limit   |      |       | Unit | Conditions                                    |
|--|--------|---------|------|-------|------|---|
|  |        | Min.    | Typ. | Max.  |      |   |
| Circuit current  | ICC    | -       | 4.4  | 7.0   | mA   | at operation in all blocks                    |
|  | IST    | -       | 1    | 10    | μA   | at standby in all blocks                      |
| Output ON resistance   | RON    | -       | 0.8  | 1.2   | Ω    | upper and lower ON resistance in total VG=10V |
| ~Boost circuit~  |        |         |      |       |      |   |
| Output voltage   | VG1    | 5.5     | 6.5  | 6.7   | V    | each input L                                  |
|  | VG2    | 4.4     | 5.2  | —     | V    | at operation in all blocks                    |
| ~Oscillation circuit~  |        |         |      |       |      |   |
| Self-propelled oscillating frequency   | fOSC   | 50      | 100  | 160   | kHz  |   |
| External clock synchronous range   | fSYNC  | —       | —    | 500   | kHz  | input from EXTCLK pin                         |
| ~Spindle (3-phase full-wave sensorless driver) block~  |        |         |      |       |      |   |
| Position detection comparator  | VCO    | -10     | —    | +10   | mV   |   |
| Detection comparator input range   | VCD    | 0       | —    | VCC-  | V    |   |
| CST charge current   | ICTO   | -3.5    | -2.1 | -0.9  | μA   | CST=1V  |
| CST discharge current  | ICTI   | 1.0     | 3.6  | 7.5   | mA   | CST=1V  |
| CSL charge current   | ICLO   | -3.5    | -7.5 | -13   | μA   | CSL=0.5V                                      |
| CSL discharge current  | ICLI   | 1.2     | 3.0  | 6.5   | μA   | CSL=0.5V                                      |
| CSL clamp H voltage  | VCLH   | 0.7     | 0.8  | 0.9   | V    |   |
| Brake comparator input current   | IBR    | —       | —    | 2.0   | μA   | BRK=VCC                                       |
| Brake comparator input offset  | VBO    | -15     | —    | +15   | mV   |   |
| Brake comparator input range   | VBD    | 0       | —    | VCC-1 | V    |   |
| FG output pull-up resistance   | RBF    | 10      | 20   | 30    | kΩ   |   |
| FG output L voltage  | VOLF   | —       | 0.2  | 0.3   | V    | Io=300μA                                      |
| RIB offset voltage   | VRO    | 10      | 18   | 30    | mV   | VM=0V RIB=500Ω                                |
| Pre-drive loop gain  | VRP    | 500     | 650  | 850   | mV   |   |
| M-phase check  | VMCK   | 400     | 500  | 600   | mV   |   |
| ~Sled, focus, tracking, PWM power supply (stepping, H-bridge, and half-bridge driver) block~ |        |         |      |       |      |   |
| Logic H level input voltage  | VINH   | VCC-0.4 | —    | VCC   | V    |   |
| Logic L level input voltage  | VINL   | 0       | —    | 0.4   | V    |   |
| Logic H level input current  | IINH1  | —       | —    | 1     | μA   | VIN=2.2V                                      |
|  | IINH2  | —       | 350  | 600   | μA   | VIN=2.2V EXTCLK pin                           |
| Logic L level input current  | IINL   | -1      | —    | —     | μA   | VIN=0V  |
| Output propagation delay time  | TRISE  | —       | 0.2  | 1     | μsec |   |
|  | TFALL  | —       | 0.1  | 0.7   | μsec |   |
| Short pulse response   | tmin   | 120     | —    | —     | nsec | input pulse width 200 ns                      |

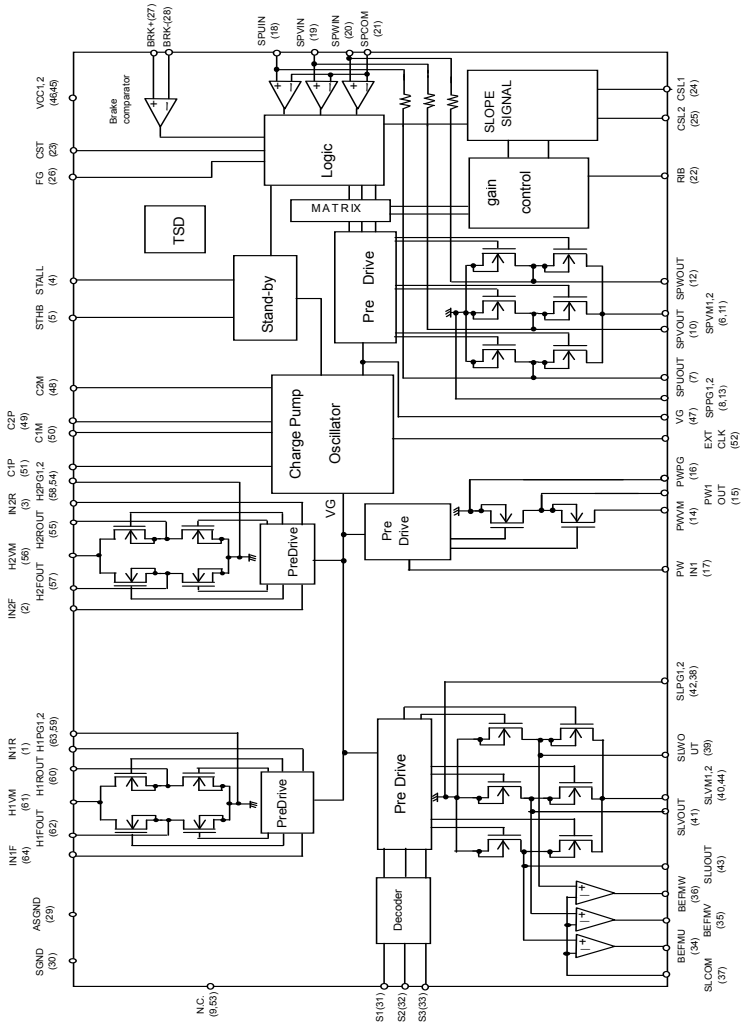
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OPackage outlines



TQFP64V outlines (Unit : mm)

OBlock diagram



OPin No./Pin name

| NO. | Pin name | NO. | Pin name |
|-----|----------|-----|----------|
| 1   | IN1R     | 33  | S3       |
| 2   | IN2F     | 34  | BEMFU    |
| 3   | IN2R     | 35  | BEMFV    |
| 4   | STALL    | 36  | BEMFW    |
| 5   | STHB     | 37  | SLCOM    |
| 6   | SPVM1    | 38  | SLPG2    |
| 7   | SPUOUT   | 39  | SLWOUT   |
| 8   | SPPG1    | 40  | SLVM2    |
| 9   | N.C      | 41  | SLVOUT   |
| 10  | SPVOUT   | 42  | SLPG1    |
| 11  | SPVM2    | 43  | SLUOUT   |
| 12  | SPWOUT   | 44  | SLVM1    |
| 13  | SPPG2    | 45  | VCC2     |
| 14  | PWVM     | 46  | VCC1     |
| 15  | PWOUT    | 47  | VG       |
| 16  | PWPG     | 48  | C2M      |
| 17  | PWIN1    | 49  | C2P      |
| 18  | SPUIN    | 50  | C1M      |
| 19  | SPVIN    | 51  | C1P      |
| 20  | SPWIN    | 52  | EXTCLK   |
| 21  | SPCOM    | 53  | N.C      |
| 22  | RIB      | 54  | H2PG2    |
| 23  | CST      | 55  | H2ROUT   |
| 24  | CSL1     | 56  | H2VM     |
| 25  | CSL2     | 57  | H2FOUT   |
| 26  | FG       | 58  | H2PG1    |
| 27  | BRK+     | 59  | H1PG2    |
| 28  | BRK-     | 60  | H1ROUT   |
| 29  | ASGND    | 61  | H1VM     |
| 30  | SGND     | 62  | H1FOUT   |
| 31  | S1       | 63  | H1PG1    |
| 32  | S2       | 64  | IN1F     |

ONotes on the use

- (1) Absolute maximum ratings  
If the input voltage or the operating temperature range exceeds absolute maximum ratings, IC may be damaged. No destruction mode (e.g., short-circuiting or open) can be specified in that case. If such special mode as will exceed absolute maximum ratings is assumed, take the physical safety measures, such as a fuse.
- (2) Power supply lines  
The regenerated current by BEMF of the motor will return. Therefore, take measures, such as the insertion of a capacitor between the power supply and GND as the pass of the regenerated current. Determine the capacitance in full consideration of all the characteristics of the electrolytic capacitor, because the electrolytic capacitor may loose some capacitance at low temperatures. If the connected power supply does not have sufficient current absorption capacity, regenerative current will cause the voltage of the power supply line to rise, which the product and its peripheral circuit may exceed the absolute maximum ratings. It is recommended to implement physical safety measures such as the insertion of a voltage clamp diode between the power supply and GND pins.
- (3) Ground potential  
Ensure a minimum GND pin potential in all operating conditions.
- (4) Design for heat  
Use the design for heat that allows for a sufficient margin in light of the power dissipation (Pd) in actual using conditions.
- (5) Operation in strong magnetic field  
Use caution when using the IC in the strong magnetic field as doing so may cause the IC to malfunction.
- (6) ASO  
When using the IC, make settings so that the output transistors for the motor will not be used under conditions in excess of the absolute maximum ratings and ASO.
- (7) Thermal shutdown circuit  
This IC incorporates thermal shutdown circuit(TSD circuit).  
When the chip temperature becomes the one shown in below, TSD circuit operates and makes the coil output to motor open. It is designed to shut the IC off from runaway thermal operation. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.

| TSD ON temperature[°C] (typ.) | Hysteresis temperature [°C] (typ.) |
|-------------------------------|------------------------------------|
| 175                           | 20                                 |

- (8) Ground wiring pattern  
When having both small signal and large current GND, it is recommended to isolate the two GND patterns, placing a single ground point at the application's reference point so that the pattern wiring resistance and voltage variations caused by large currents do not cause voltage variations of the small signal GND. Be careful not to change the GND wiring pattern of any external parts, either.

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