

# M63993FP

## HIGH VOLTAGE 3PHASE BRIDGE DRIVER

### DESCRIPTION

M63993FP is high voltage Power MOSFET and IGBT module driver for 3Phase bridge applications.

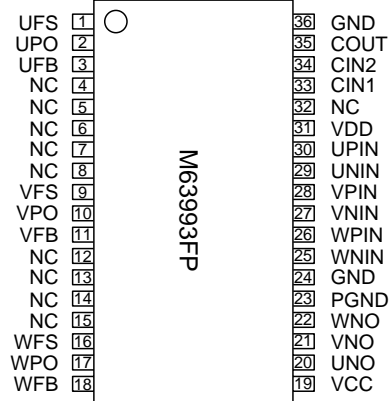
### FEATURES

- FLOATING SUPPLY VOLTAGE ..... 600V
- OUTPUT CURRENT ..... ±300mA
- 3PHASE BRIDGE DRIVER
- SSOP-36

### APPLICATIONS

MOSFET and IGBT inverter module driver for refrigerator, air-conditioner, washing machine, AC-servomotor and general purpose.

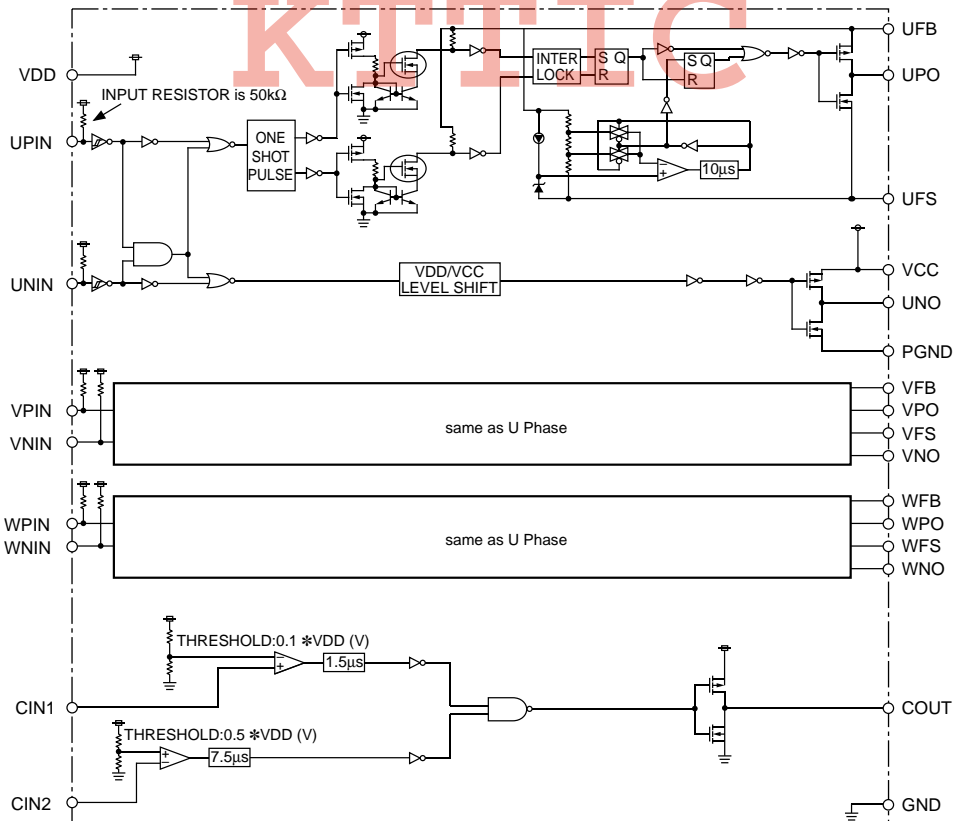
### PIN CONFIGURATION (TOP VIEW)



NC:NO CONNECTION

PACKAGE TYPE 36P2R

### BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

| Symbol     | Parameter                                 | Conditions               | Ratings         | Unit  |
|------------|---|--------------------------|-----------------|-------|
| U, V, WFB  | High Side Floating Supply Voltage         |                          | -0.5~624        | V     |
| U, V, WFS  | High Side Floating Supply Offset Voltage  |                          | VB-24 ~ VB+0.5  | V     |
| VU, V, WPO | High Side Output Voltage                  |                          | VS-0.5 ~ VB+0.5 | V     |
| VCC        | Low Side Fixed Supply Voltage             |                          | -0.5 ~ 24       | V     |
| VU, V, WNO | Low Side Output Voltage                   |                          | -0.5 ~ VCC+0.5  | V     |
| VDD        | Logic Supply Voltage                      |                          | -0.5 ~ 7        | V     |
| VIN        | Logic Input Voltage                       | U, V, WPI N, U, V, WNI N | -0.5 ~ VDD+0.5  | V     |
| dVS/dt     | Allowable Offset Supply Voltage Transient |                          | ±50             | V/ns  |
| Pt         | Package Power Dissipation                 | Ta = 25°C, On Board      | 1.2             | W     |
| K θ        | Linear Derating Factor                    | Ta > 25°C, On Board      | 12.0            | mW/°C |
| Rth(j-c)   | Junction Case Thermal Resistance          |                          | 30              | °C/W  |
| Tj         | Junction Temperature                      |                          | -30 ~ 125       | °C    |
| Topr       | Operation Temperature                     |                          | -30 ~ 100       | °C    |
| Tstg       | Storage Temperature                       |                          | -40 ~ 125       | °C    |

**RECOMMENDED OPERATING CONDITIONS**

| Symbol    | Parameter                                | Test Conditions          | Limits |      |       | Unit |
|-----------|--|--------------------------|--------|------|-------|------|
|           |  |                          | Min.   | Typ. | Max.  |      |
| U, V, WFB | High Side Floating Supply Voltage        |                          | VS+10  | —    | VS+20 | V    |
| U, V, WFS | High Side Floating Supply Offset Voltage |                          | -5     | —    | 500   | V    |
| VCC       | Low Side Fixed Supply Voltage            |                          | 10     | —    | 20    | V    |
| VDD       | Logic Supply Voltage                     |                          | 4.5    | —    | 5.5   | V    |
| VIN       | Logic Input Voltage                      | U, V, WPI N, U, V, WNI N | 0      | —    | VDD   | V    |
| VPOND     | Output GND Voltage                       |                          | -5     | —    | 5     | V    |

**FUNCTION TABLE 1 (INPUT, OUTPUT and UV)**

| U, V, WPIN | U, V, WNIN | UV | U, V, WPO | U, V, WNO | Behavioral state                                     |
|------------|------------|----|-----------|-----------|--|
| H          | H          | H  | L         | L         | Normal OFF   |
| H          | L          | H  | L         | H         | *NO ON   |
| L          | H          | H  | H         | L         | *PO ON   |
| L          | L          | X  | L         | L         | *PO = OFF, *NO = OFF, *PIN = *NIN = L simultaneously |
| X          | H          | L  | L         | L         | *PO OFF, *VB UV tripped                              |
| H          | L          | L  | L         | H         | *NO ON, *VB UV tripped                               |

Note : "L" state of \*VB UV mean that UV trip voltage.

**FUNCTION TABLE 2 (COMPARATOR)**

| CIN1 | CIN2 | COUT | Behavioral state    |
|------|------|------|---------------------|
| L    | H    | H    | COUT is normal HIGH |
| H    | X    | L    |                     |
| X    | L    | L    |                     |

**ELECTRICAL CHARACTERISTICS (Ta=25°C, VCC=VBS=15V, VDD=5V unless otherwise specified)**

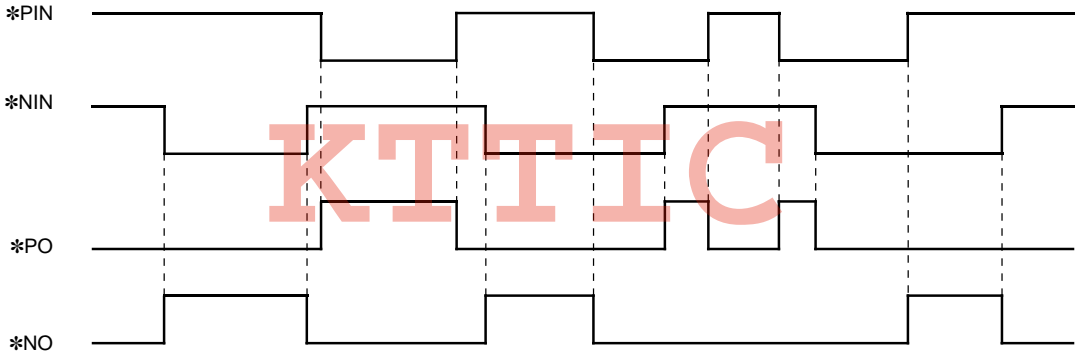
| Symbol   | Parameter                                      | Test conditions                   | Limits |      |      | Unit |
|----------|--|-----------------------------------|--------|------|------|------|
|          |  |                                   | Min.   | Typ. | Max. |      |
| IFS      | Floating Supply Leakage Current                | VB=VS=600V per 1 phase            | —      | —    | 1    | μA   |
| IBS      | VBS standby Current                            |                                   | —      | 0.48 | —    | mA   |
| ICC      | VCC standby Current                            |                                   | —      | —    | 0.1  | mA   |
| IDD      | VDD standby Current                            |                                   | —      | 0.5  | —    | mA   |
| VOH      | High Level Output Voltage                      | IO=0A, *NO, *PO                   | 14.9   | —    | —    | V    |
| VOL      | Low Level Output Voltage                       | IO=0A, *NO, *PO                   | —      | —    | 0.1  | V    |
| VIH      | High Level Input Threshold Voltage             | *PIN, *NIN                        | 2.1    | 3.0  | 4.0  | V    |
| VIL      | Low Level Input Threshold Voltage              | *PIN, *NIN                        | 0.6    | 1.5  | 1.9  | V    |
| IIH      | High Level Input Bias Current                  | *PIN, *NIN=5V                     | —      | —    | 1.0  | μA   |
| IIL      | Low Level Input Bias Current                   | *PIN, *NIN=0V                     | —      | 100  | 300  | μA   |
| VUVT     | VBS Supply UV Trip Voltage                     |                                   | 7.0    | 8.0  | 9.0  | V    |
| VUVR     | VBS Supply UV Reset Voltage                    |                                   | 7.5    | 8.5  | 9.5  | V    |
| tUV      | VBS Supply UV Filter Time                      |                                   | —      | 7.5  | —    | μs   |
| IOH      | Output High Level Short Circuit Pulsed Current | *PO*NO=0V, *PIN, *NIN=5V,PW<10μs  | —      | -300 | —    | mA   |
| IOL      | Output Low Level Short Circuit Pulsed Current  | *PO*NO=15V, *PIN, *NIN=0V,PW<10μs | —      | 300  | —    | mA   |
| tdLH(HO) | High Side Turn-On Propagation Delay            | CL=1000pF between HO – VS         | 250    | 300  | 350  | ns   |
| tdHL(HO) | High Side Turn-Off Propagation Delay           | CL=1000pF between HO – VS         | 230    | 280  | 330  | ns   |
| tr(HO)   | High Side Turn-On Rise Time                    | CL=1000pF between HO – VS         | —      | 130  | —    | ns   |
| tf(HO)   | High Side Turn-Off Fall Time                   | CL=1000pF between HO – VS         | —      | 100  | —    | ns   |
| tdLH(LO) | Low Side Turn-On Propagation Delay             | CL=1000pF between LO – GND        | 250    | 300  | 350  | ns   |
| tdHL(LO) | Low Side Turn-Off Propagation Delay            | CL=1000pF between LO – GND        | 230    | 280  | 330  | ns   |
| tr(LO)   | Low Side Turn-On Rise Time                     | CL=1000pF between LO – GND        | —      | 130  | —    | ns   |
| tf(LO)   | Low Side Turn-Off Fall Time                    | CL=1000pF between LO – GND        | —      | 100  | —    | ns   |
| VCIN1th  | Comparator 1 Threshold Voltage                 | VDD=5V                            | 0.47   | 0.5  | 0.53 | V    |
| tVCIN1   | Comparator 1 Filter Time                       |                                   | —      | 1.5  | —    | μs   |
| VCIN2th  | Comparator 2 Threshold Voltage                 | VDD=5V                            | 2.4    | 2.5  | 2.6  | V    |
| tVCIN2   | Comparator 2 Filter Time                       |                                   | —      | 7.5  | —    | μs   |
| VCOH     | Comparator H Level Output Voltage              | ICO=500μA                         | 4.5    | —    | —    | V    |
| VCOL     | Comparator L Level Output Voltage              | ICO=-500μA                        | —      | —    | 0.5  | V    |

**LEAD DEFINITIONS**

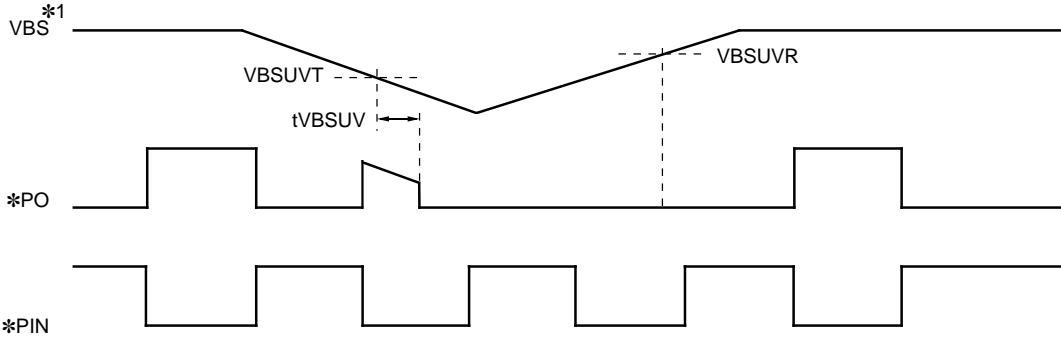
| Lead symbol      | Description                                       |
|------------------|---|
| UFS, VFS, WFS    | High Side floating supply (minus side)            |
| UPO, VPO, WPO    | High side gate drive output                       |
| UFB, VFB, WFB    | High Side floating supply (plus side)             |
| VCC              | Low side supply                                   |
| UNO, VNO, WNO    | Low side gate drive output                        |
| PGND             | Low side power ground                             |
| UNIN, VNIN, WNIN | Logic input for low side gate driver output (LO)  |
| UPIN, VPIN, WPIN | Logic input for high side gate driver output (HO) |
| VDD              | Logic supply                                      |
| CIN1             | Input for comparator 1                            |
| CIN2             | Input for comparator 2                            |
| COUT             | Comparator output                                 |

**TIMING DIAGRAM**

1. Input/Output Timing Diagram



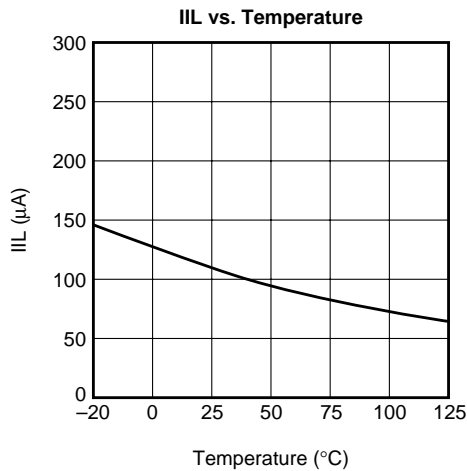
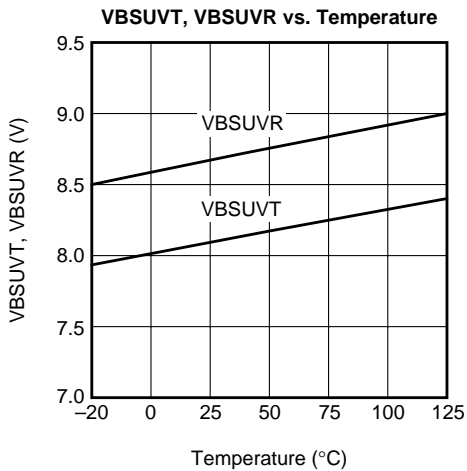
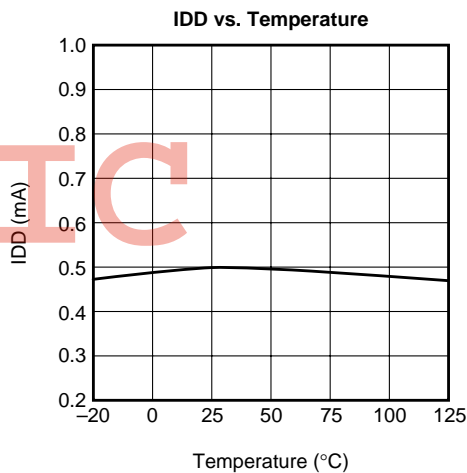
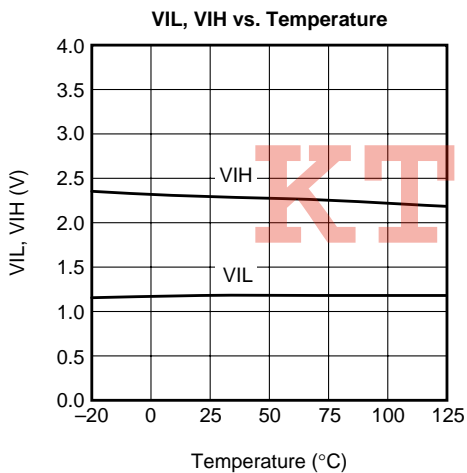
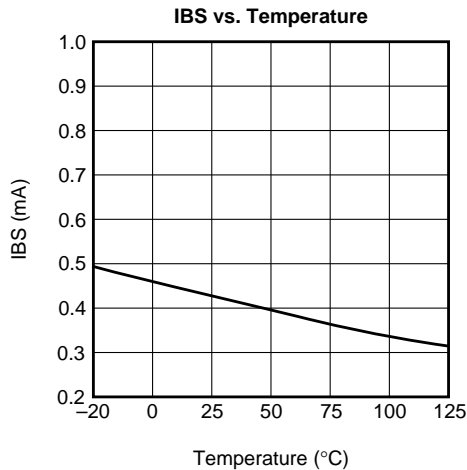
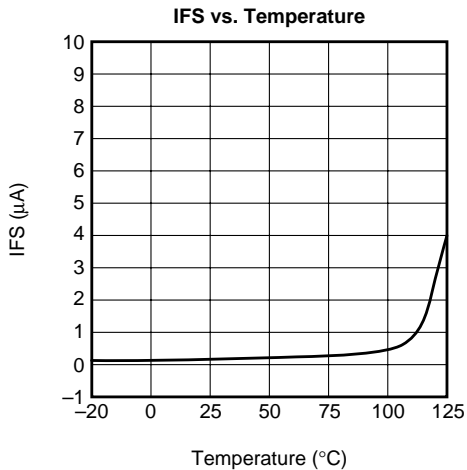
2. VBS Supply Undervoltage Lockout Timing Diagram



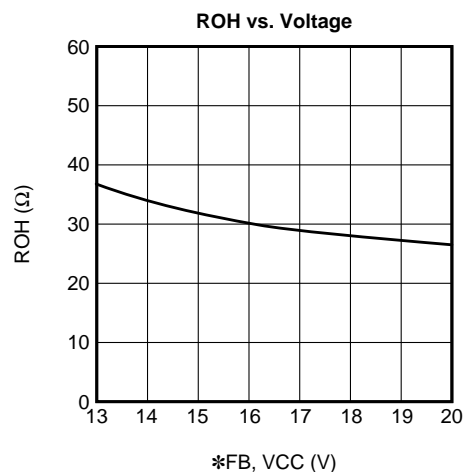
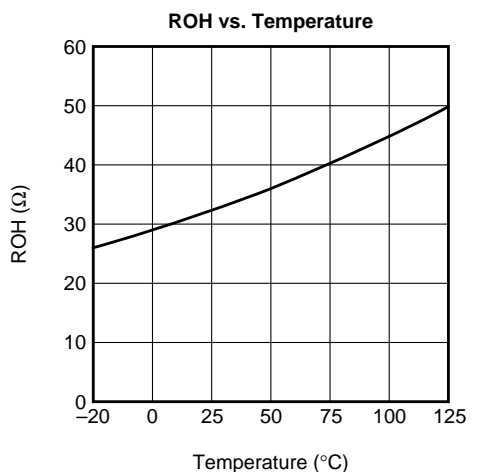
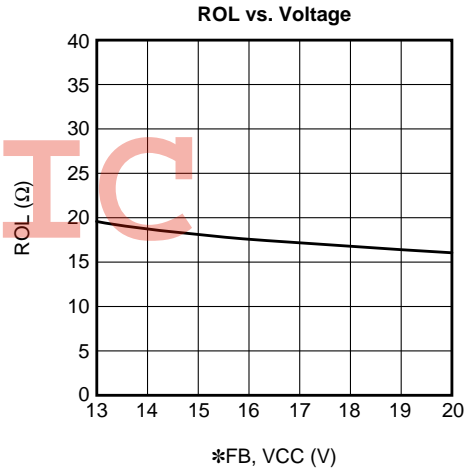
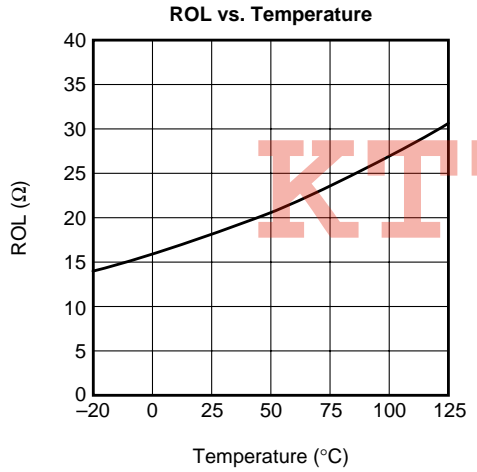
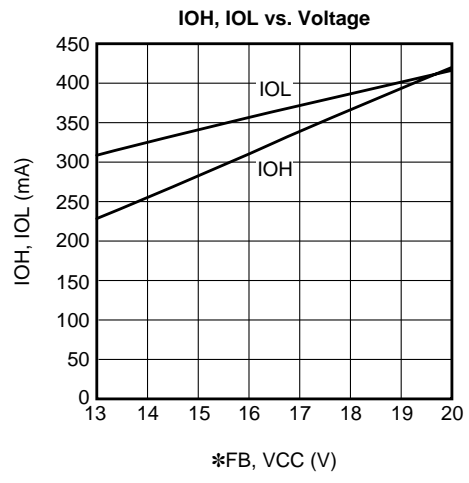
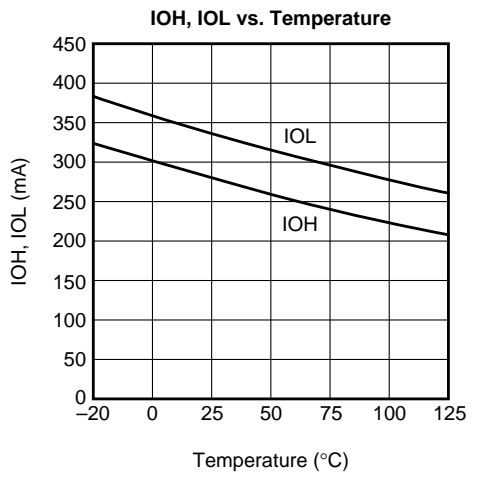
\*1:  $VBS = *FB \cdot *FS$

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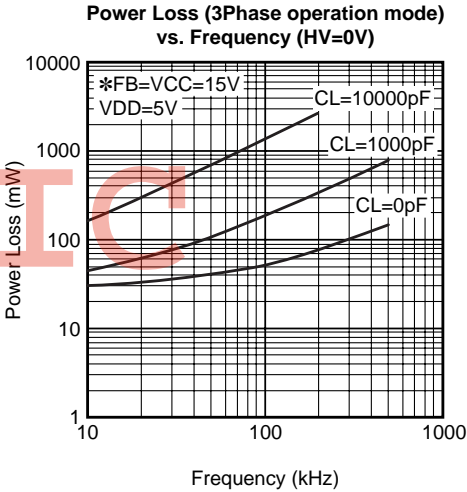
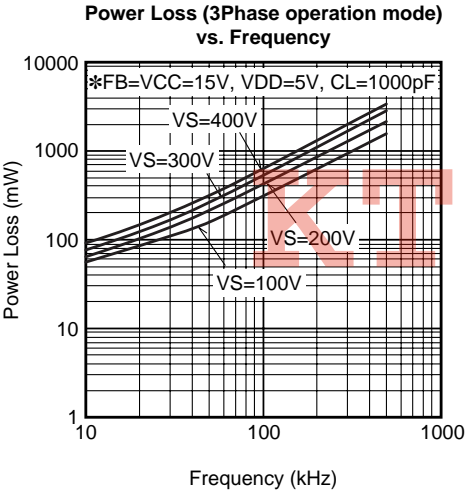
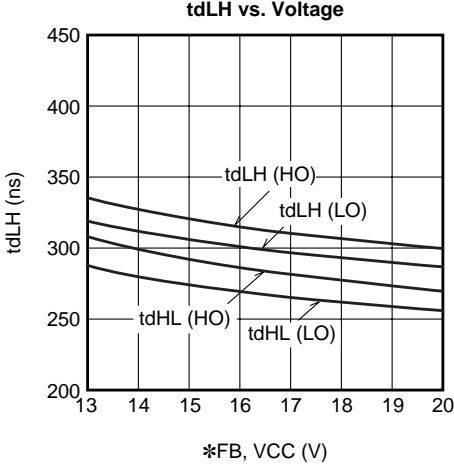
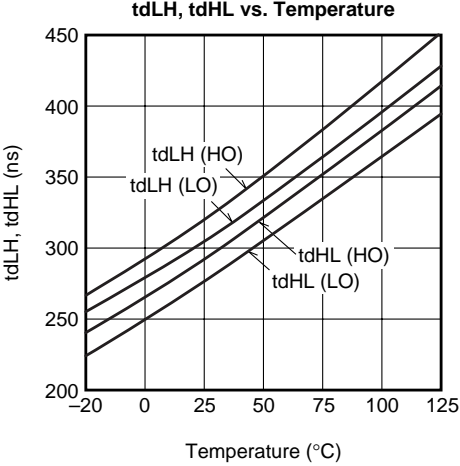
**PERFORMANCE CURVES**



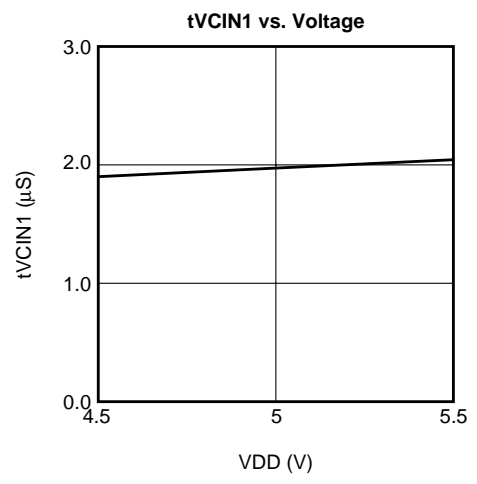
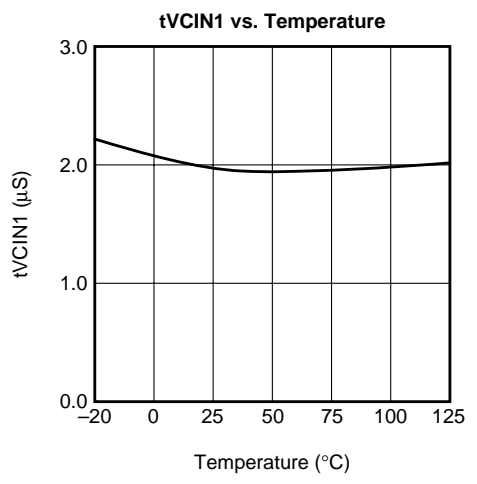
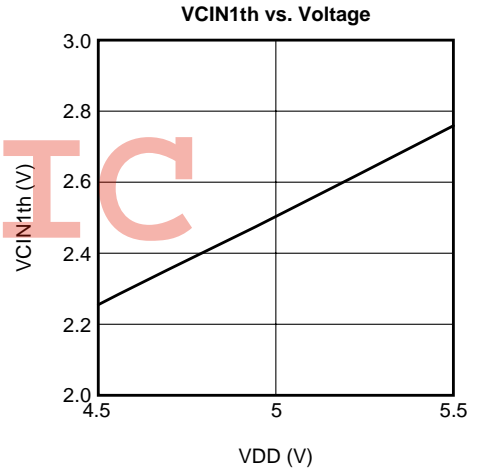
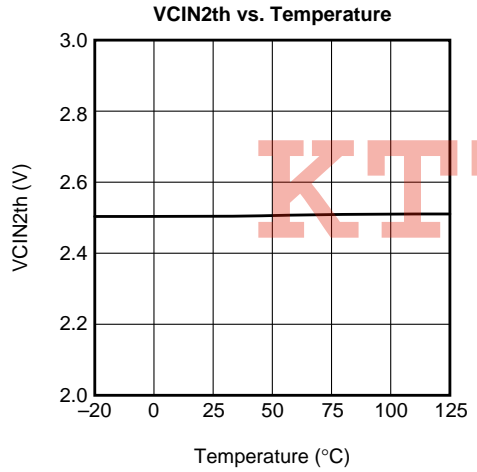
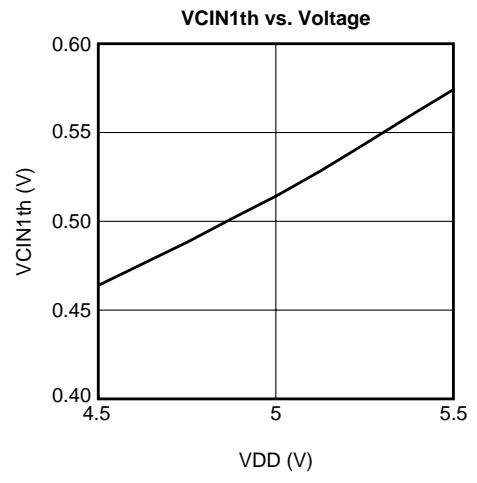
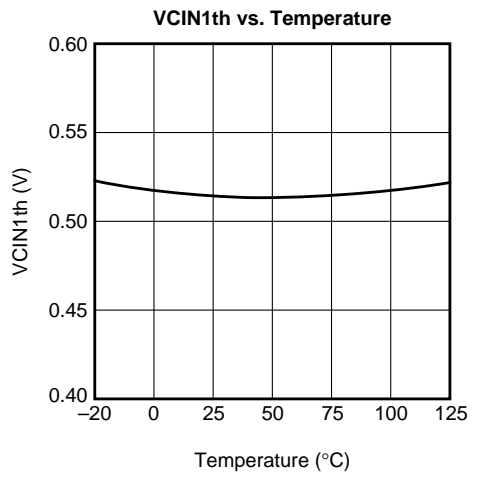
**HIGH VOLTAGE 3PHASE BRIDGE DRIVER**



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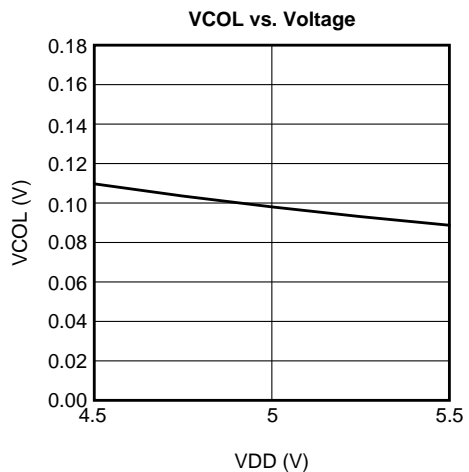
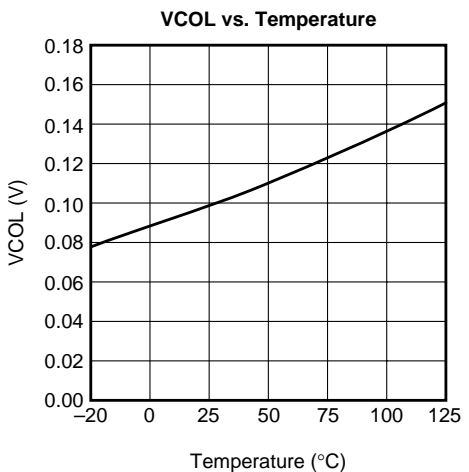
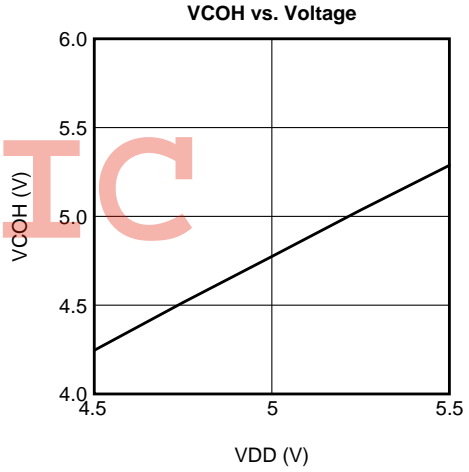
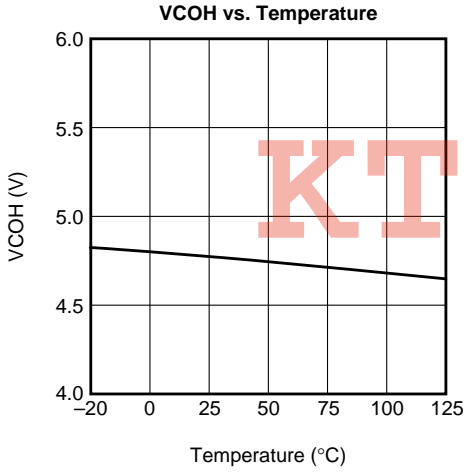
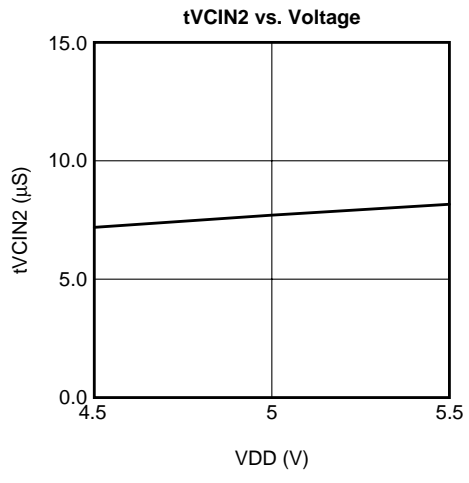
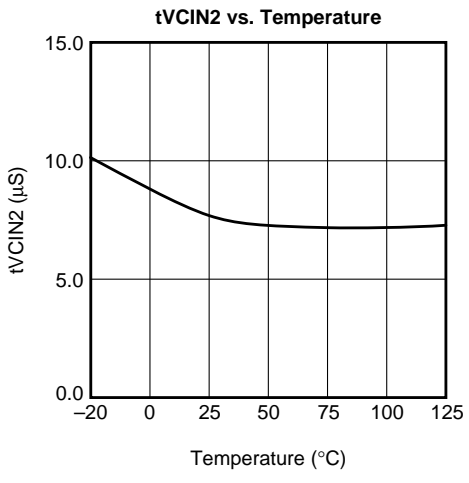


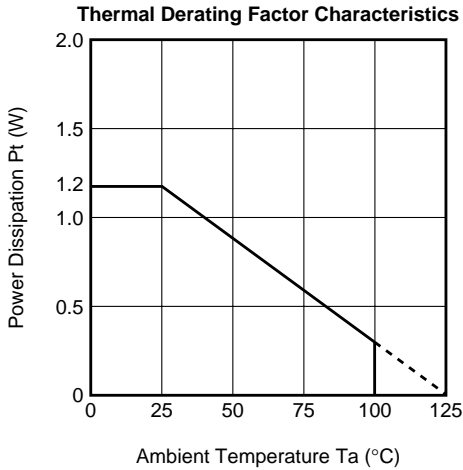
HIGH VOLTAGE 3PHASE BRIDGE DRIVER





HIGH VOLTAGE 3PHASE BRIDGE DRIVER





# KTTIC

**PACKAGE OUTLINE**

**36P2R-D**

**Plastic 36pin 450mil SSOP**

|                   |            |           |               |
|-------------------|------------|-----------|---------------|
| EIAJ Package Code | JEDEC Code | Weight(g) | Lead Material |
| SSOP36-P-450-0.80 | -          | 0.53      | Cu Alloy      |

**Recommended Mount Pad**

| Symbol | Dimension in Millimeters |       |       |
|--------|--------------------------|-------|-------|
|        | Min                      | Nom   | Max   |
| A      | -                        | -     | 2.35  |
| A1     | 0                        | 0.1   | 0.2   |
| A2     | -                        | 2.05  | -     |
| b      | 0.3                      | 0.35  | 0.45  |
| c      | 0.18                     | 0.2   | 0.25  |
| D      | 14.8                     | 15.0  | 15.2  |
| E      | 8.2                      | 8.4   | 8.6   |
| e      | -                        | 0.8   | -     |
| HE     | 11.63                    | 11.93 | 12.23 |
| L      | 0.3                      | 0.5   | 0.7   |
| L1     | -                        | 1.765 | -     |
| y      | -                        | -     | 0.1   |
| θ      | 0°                       | -     | 8°    |
| b2     | -                        | 0.5   | -     |
| e1     | -                        | 11.43 | -     |
| l2     | 1.27                     | -     | -     |