

# MCT6, MCT61, MCT62 Dual Phototransistor Optocouplers

## Features

- Two isolated channels per package
- Two packages fit into a 16 lead DIP socket
- Choice of three current transfer ratios
- Underwriters Laboratory (U.L.) recognized File E90700
- VDE approved for IEC60747-5-2

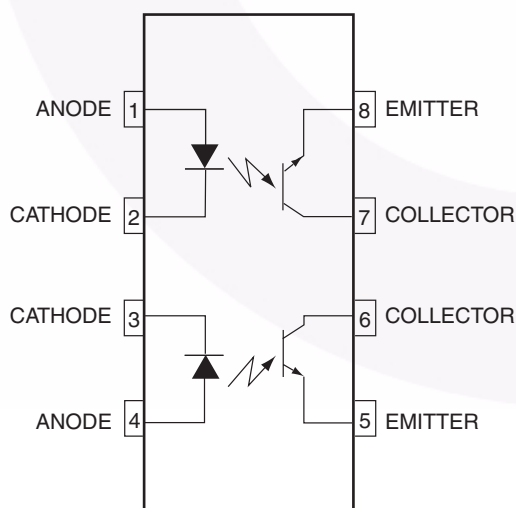
## Applications

- AC line/digital logic – isolate high voltage transients
- Digital logic/digital logic – eliminate spurious grounds
- Digital logic/AC triac control – isolate high voltage transients
- Twisted pair line receiver – eliminate ground loop feedthrough
- Telephone/telegraph line receiver – isolate high voltage transients
- High frequency power supply feedback control – maintain floating grounds and transients
- Relay contact monitor – isolate floating grounds and transients
- Power supply monitor – isolate transients

## Description

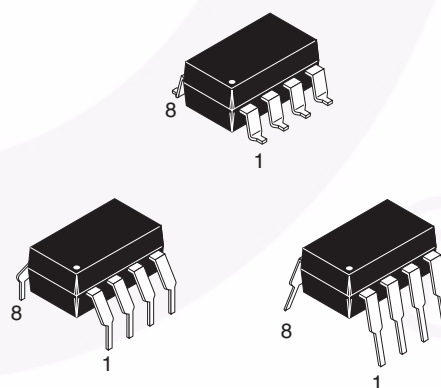
The MCT6X Optocouplers have two channels for density applications. For four channel applications, two-packages fit into a standard 16-pin DIP socket. Each channel is an NPN silicon planar phototransistor optically coupled to a gallium arsenide infrared emitting diode.

## Schematic



**Equivalent Circuit**

## Package Outlines



## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol                  | Rating                                                                           | Value          | Unit  |
|-------------------------|----------------------------------------------------------------------------------|----------------|-------|
| TOTAL DEVICE            |                                                                                  |                |       |
| T <sub>STG</sub>        | Storage Temperature                                                              | -55 to +150    | °C    |
| T <sub>OPR</sub>        | Operating Temperature                                                            | -55 to +100    | °C    |
| T <sub>SOL</sub>        | Lead Solder Temperature<br>(Refer to Reflow Temperature Profile)                 | 260 for 10 sec | °C    |
| P <sub>D</sub>          | Total Device Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C      | 400            | mW    |
|                         |                                                                                  | 5.33           | mW/°C |
| EMITTER (Each channel)  |                                                                                  |                |       |
| I <sub>F</sub>          | Forward Current – Continuous                                                     | 60             | mA    |
| I <sub>F(pk)</sub>      | Forward Current – Peak (PW = 1μs, 300pps)                                        | 3              | A     |
| V <sub>R</sub>          | Reverse Voltage                                                                  | 3.0            | V     |
| P <sub>D</sub>          | LED Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C (Total Input) | 100            | mW    |
|                         |                                                                                  | 1.3            | mW/°C |
| DETECTOR (Each channel) |                                                                                  |                |       |
| I <sub>C</sub>          | Collector Current – Continuous                                                   | 30             | mA    |
| P <sub>D</sub>          | Detector Power Dissipation @ T <sub>A</sub> = 25°C<br>Derate above 25°C          | 150            | mW    |
|                         |                                                                                  | 2.0            | mW/°C |

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)**Individual Component Characteristics**

| Symbol          | Parameter                           | Test Conditions                          | Min. | Typ.* | Max. | Units         |
|-----------------|-------------------------------------|------------------------------------------|------|-------|------|---------------|
| <b>EMITTER</b>  |                                     |                                          |      |       |      |               |
| $V_F$           | Input Forward Voltage               | $I_F = 20\text{mA}$                      |      | 1.2   | 1.5  | V             |
| $V_R$           | Reverse Voltage                     | $I_R = 10\mu\text{A}$                    | 3.0  | 25    |      | V             |
| $I_R$           | Reverse Current                     | $V_R = 5\text{V}$                        |      | 0.001 | 10   | $\mu\text{A}$ |
| $C_J$           | Junction Capacitance                | $V_F = 0\text{V}$ , $f = 1\text{MHz}$    |      | 50    |      | pF            |
| <b>DETECTOR</b> |                                     |                                          |      |       |      |               |
| $BV_{CEO}$      | Collector-Emitter Breakdown Voltage | $I_C = 1.0\text{mA}$ , $I_F = 0$         | 30   | 85    |      | V             |
| $BV_{ECO}$      | Emitter-Collector Breakdown Voltage | $I_E = 100\mu\text{A}$ , $I_F = 0$       | 6    | 13    |      | V             |
| $I_{CEO}$       | Collector-Emitter Dark Current      | $V_{CE} = 10\text{V}$ , $I_F = 0$        |      | 5     | 100  | nA            |
| $C_{CE}$        | Capacitance                         | $V_{CE} = 0\text{V}$ , $f = 1\text{MHz}$ |      | 8     |      | pF            |

**Transfer Characteristics**

| Symbol                                         | Characteristic              | Test Conditions                                                    | Min. | Typ.* | Max. | Units |
|------------------------------------------------|-----------------------------|--------------------------------------------------------------------|------|-------|------|-------|
| SWITCHING CHARACTERISTICS (AC)                 |                             |                                                                    |      |       |      |       |
| t <sub>on</sub>                                | Non-Saturated Turn-on Time  | R <sub>L</sub> = 100Ω, I <sub>C</sub> = 2mA, V <sub>CC</sub> = 10V |      | 2.4   |      | μs    |
| t <sub>off</sub>                               | Non-Saturated Turn-off Time |                                                                    |      | 2.4   |      | μs    |
| CURRENT TRANSFER RATIO, COLLECTOR-EMITTER (DC) |                             |                                                                    |      |       |      |       |
| CTR                                            | MCT6                        | I <sub>F</sub> = 10mA, V <sub>CE</sub> = 10V                       | 20   |       |      | %     |
|                                                | MCT61                       | I <sub>F</sub> = 5mA, V <sub>CE</sub> = 5V                         | 50   |       |      |       |
|                                                | MCT62                       |                                                                    | 100  |       |      |       |
| V <sub>CE(sat)</sub>                           | Saturation Voltage          | I <sub>F</sub> = 16mA, I <sub>C</sub> = 2mA                        |      | 0.15  | 0.40 | V     |

**Isolation Characteristics**

| Symbol    | Characteristic                 | Test Conditions                                   | Min.      | Typ.* | Max. | Units    |
|-----------|--------------------------------|---------------------------------------------------|-----------|-------|------|----------|
| $V_{ISO}$ | Input-Output Isolation Voltage | $I_{I-O} \leq 10\mu\text{A}$ , $t = 1\text{min.}$ | 5000      |       |      | Vac(rms) |
| $R_{ISO}$ | Isolation Resistance           | $V_{I-O} = 500\text{VDC}$                         | $10^{11}$ |       |      | $\Omega$ |
| $C_{ISO}$ | Isolation Capacitance          | $f = 1\text{MHz}$                                 |           | 0.5   |      | pF       |

\*All typicals at  $T_A = 25^\circ\text{C}$

## Typical Performance Curves

Fig. 1 Normalized CTR vs. Forward Current

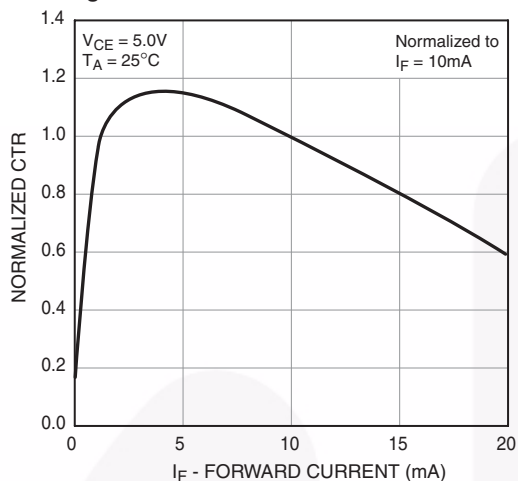


Fig. 2 Normalized CTR vs. Ambient Temperature

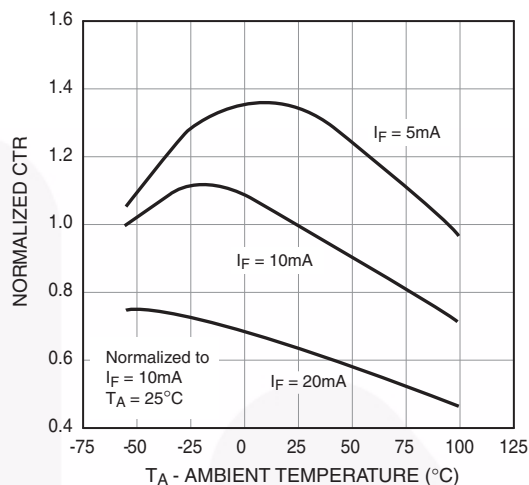


Fig. 3 Dark Current vs. Ambient Temperature

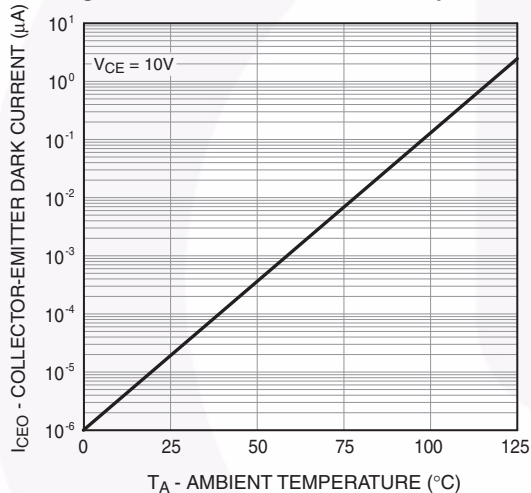


Fig. 4 Switching Speed vs. Load Resistor

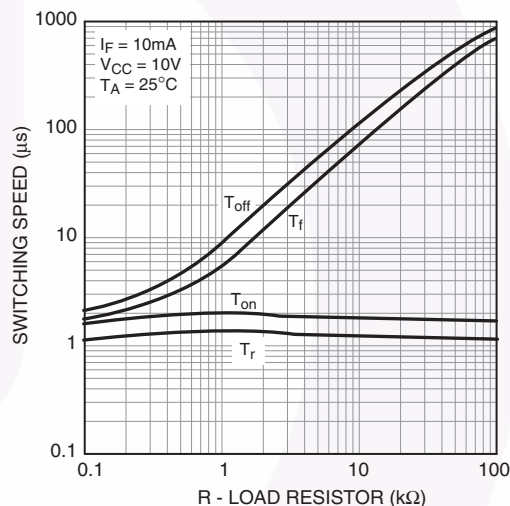


Fig. 5 LED Forward Voltage vs. Forward Current

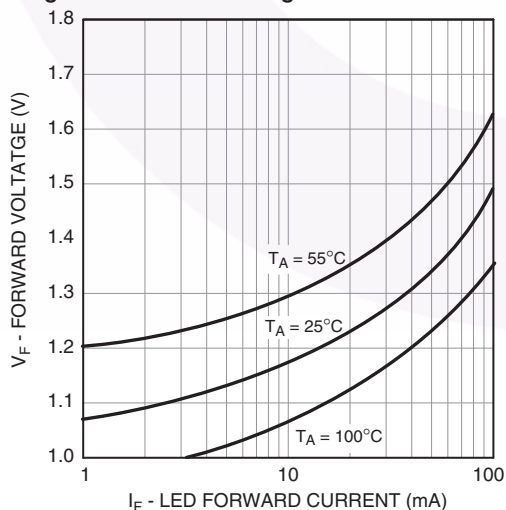
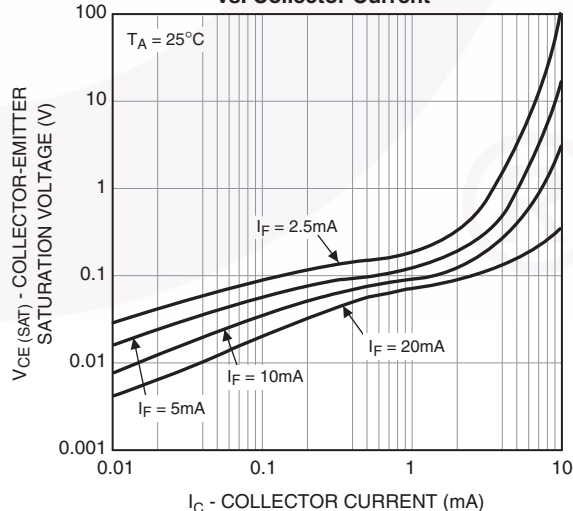
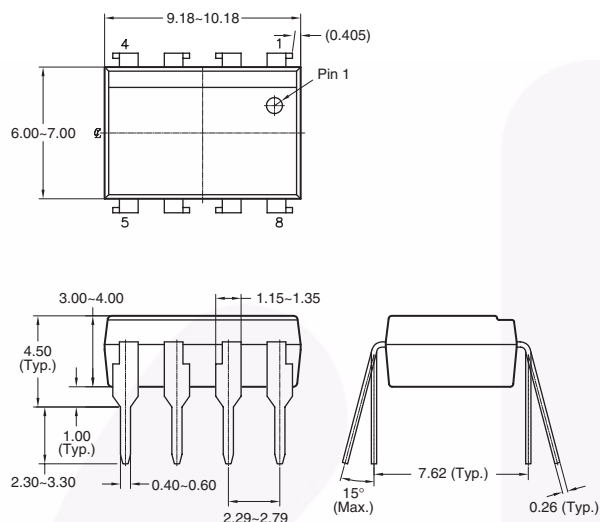


Fig. 6 Collector-Emitter Saturation Voltage vs. Collector Current

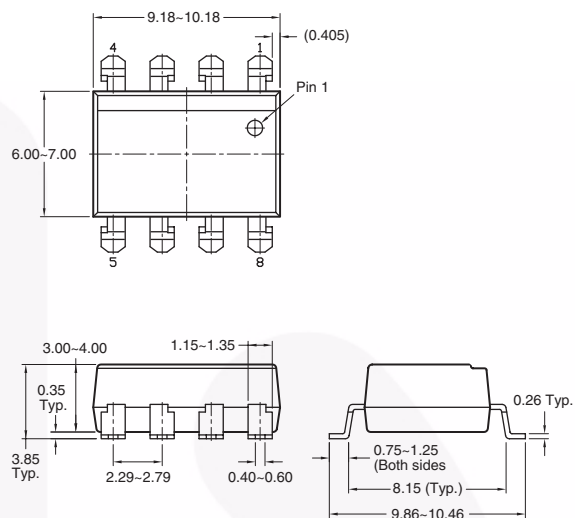


## Package Dimensions

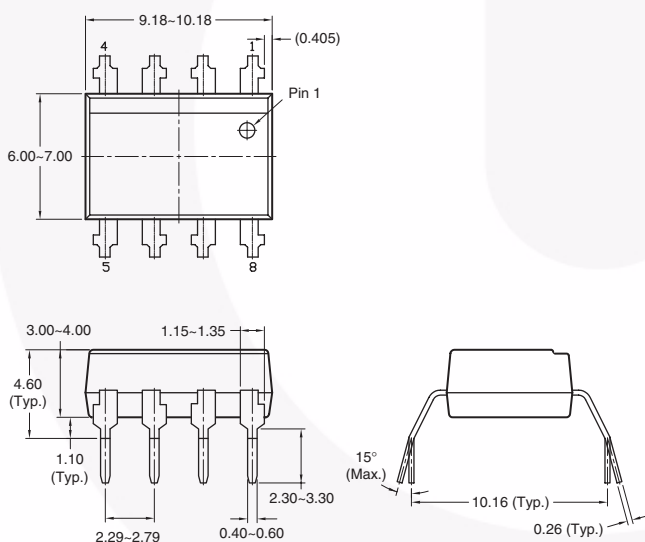
### Through Hole



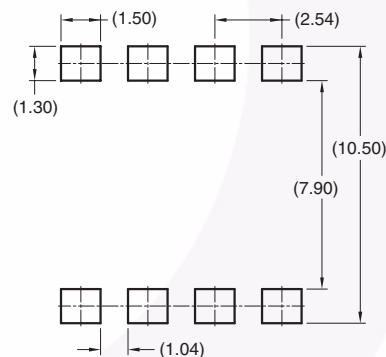
### Surface Mount



### 0.4" Lead Spacing



### Recommend Pad Layout for Surface Mount Leadform



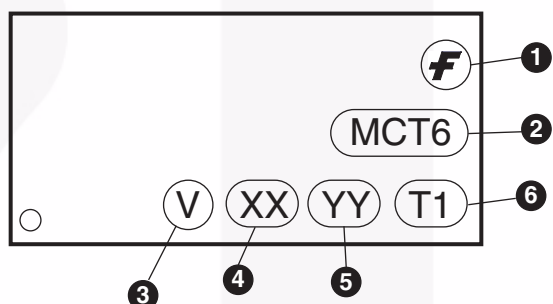
### Note:

All dimensions are in millimeters.

## Ordering Information

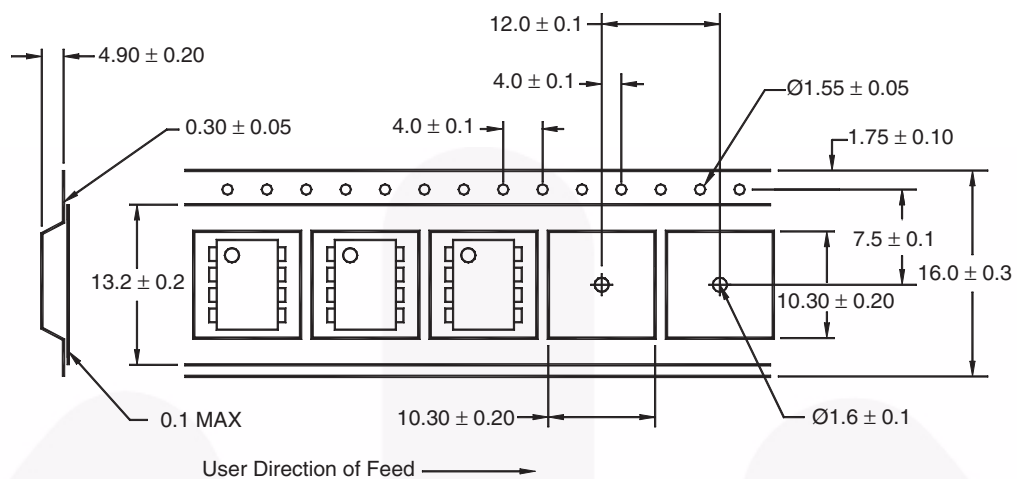
| Option    | Example Part Number | Description                                |
|-----------|---------------------|--------------------------------------------|
| No Option | MTC6                | Standard Through Hole                      |
| S         | MTC6S               | Surface Mount Lead Bend                    |
| SD        | MTC6SD              | Surface Mount; Tape and Reel               |
| 300       | MCT6300             | VDE Approved                               |
| 3S        | MCT63S              | Surface Mount Lead Bend; VDE Approved      |
| 3SD       | MCT63SD             | Surface Mount; Tape and Reel; VDE Approved |
| 300W      | MTC6300W            | 0.4" Lead Spacing; VDE Approved            |

## Marking Information



| Definitions |                                                                                        |
|-------------|----------------------------------------------------------------------------------------|
| 1           | Fairchild logo                                                                         |
| 2           | Device number                                                                          |
| 3           | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4           | Two digit year code, e.g., '03'                                                        |
| 5           | Two digit work week ranging from '01' to '53'                                          |
| 6           | Assembly package code                                                                  |

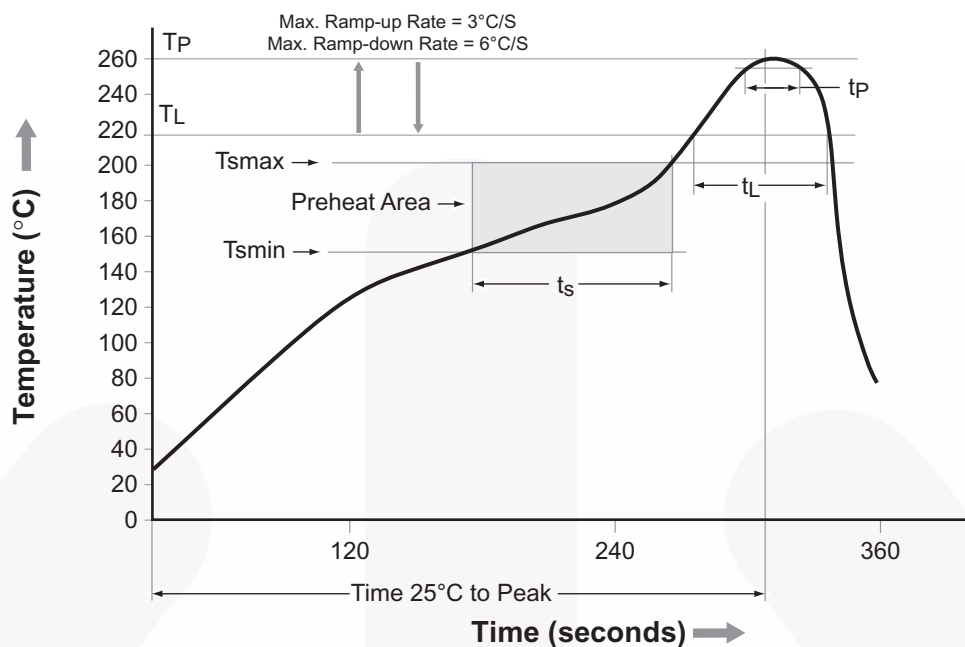
## Carrier Tape Specifications



**Note:**

All dimensions are in inches (millimeters)

## Reflow Profile



| Profile Feature                                                       | Pb-Free Assembly Profile |
|-----------------------------------------------------------------------|--------------------------|
| Temperature Min. (T <sub>smin</sub> )                                 | 150°C                    |
| Temperature Max. (T <sub>smax</sub> )                                 | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> ) | 60–120 seconds           |
| Ramp-up Rate (t <sub>L</sub> to t <sub>p</sub> )                      | 3°C/second max.          |
| Liquidous Temperature (T <sub>L</sub> )                               | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )             | 60–150 seconds           |
| Peak Body Package Temperature                                         | 260°C +0°C / -5°C        |
| Time (t <sub>p</sub> ) within 5°C of 260°C                            | 30 seconds               |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                    | 6°C/second max.          |
| Time 25°C to Peak Temperature                                         | 8 minutes max.           |





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| Build it Now™                                                                       | Green FPS™                                                                          | Programmable Active Droop™                                                                         | TinyBoost™                                                                                  |
| CorePLUS™                                                                           | Green FPS™ e-Series™                                                                | QFET®                                                                                              | TinyBuck™                                                                                   |
| CorePOWER™                                                                          | Gmax™                                                                               | QS™                                                                                                | TinyCalc™                                                                                   |
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| Current Transfer Logic™                                                             | ISOPLANAR™                                                                          |  ™                | TinyPower™                                                                                  |
| DEUXPEED®                                                                           | MegaBuck™                                                                           | Saving our world, 1mW/W/kW at a time™                                                              | TinyPWM™                                                                                    |
| Dual Cool™                                                                          | MICROCOUPLER™                                                                       | SignalWise™                                                                                        | TinyWire™                                                                                   |
| EcoSPARK®                                                                           | MicroFET™                                                                           | SmartMax™                                                                                          | TriFault Detect™                                                                            |
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| Fairchild Semiconductor®                                                            | MotionMax™                                                                          | SuperFET™                                                                                          | UHC®                                                                                        |
| FACT Quiet Series™                                                                  | Motion-SPM™                                                                         | SuperSOT™-3                                                                                        | Ultra FRFET™                                                                                |
| FACT®                                                                               | OptoHiT™                                                                            | SuperSOT™-6                                                                                        | UniFET™                                                                                     |
| FAST®                                                                               | OPTOLOGIC®                                                                          | SuperSOT™-8                                                                                        | VCX™                                                                                        |
| FastvCore™                                                                          | OPTOPLANAR®                                                                         | SupreMOS™                                                                                          | VisualMax™                                                                                  |
| FETBench™                                                                           |  ™ | SyncFET™                                                                                           | XS™                                                                                         |
| FlashWriter®*                                                                       | PDP SPM™                                                                            | Sync-Lock™                                                                                         |                                                                                             |
| FPS™                                                                                | Power-SPM™                                                                          |  SYSTEM GENERAL®* |                                                                                             |
| F-PFS™                                                                              |                                                                                     |                                                                                                    |                                                                                             |

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