# ITC117PL
## Integrated Telecom Circuits

INTEGRATED CIRCUITS DIVISION


| Parameter | Rating | Units |
|---|---|---|
| Relay Blocking Voltage | 350 | V |
| Relay Load Current | 120 | $mA_{rms}$ / $mA_{DC}$ |
| Relay On-Resistance (max) | 20 | Ω |
| Bridge Rectifier Reverse Voltage | 100 | V |
| Darlington Collector Current | 120 | mA |
| Darlington Current Gain | 10,000 | - |

### Features
- Current Limiting
- 3750$V_{rms}$ Input/Output Isolation
- 2mW Hook Switch Drive Power (Logic Compatible)
- Full-Wave Bridge Rectifier
- Darlington Transistor for Electronic Inductor “Dry” Circuits
- Full-Wave Current Detector for Ring Signal or Loop Current Detect
- JEDEC Standard Lead Configuration
- Board Space and Cost Savings
- Small 16-Pin SOIC Package (PCMCIA Compatible)

### Applications
- Data/Fax Modem
- Voice Mail Systems
- Telephone Sets
- Computer Telephony Integration
- Set Top Box Modems

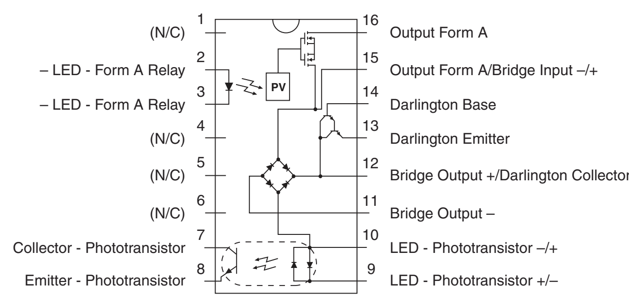
### Description
The Integrated Telecom Circuit combines a single-pole, normally open (1-Form-A) solid state relay, a bridge rectifier, a Darlington transistor, and an optocoupler into one 16-pin SOIC package, consolidating designs and reducing component count in telecom applications. The ITC117PL's relay features the added benefit of current limiting, and the optocoupler provides for full-wave detection of ring signals.

### Approvals
- UL Recognized Component: File E76270
- CSA Certified Component: Certificate 1305490
- EN62368-1 Certified Component:
  TUV Certificate: B 082667 0008 Rev 00

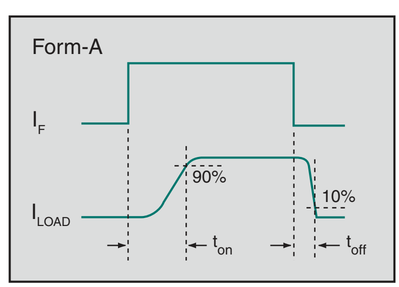
### Ordering Information

| Part # | Description |
|---|---|
| ITC117PL | 16-Pin SOIC (50/Tube) |
| ITC117PLTR | 16-Pin SOIC (1000/Reel) |

### Pin Configuration




**Switching Characteristics of Normally Open Devices**



## Absolute Maximum Ratings @ 25°C

| Parameter | Ratings | Units |
|---|---|---|
| Input Control Current, Relay | 50 | mA |
| Input Control Current, Detector | 100 | mA |
| Total Package Dissipation [1] | 1 | W |
| Isolation Voltage, Input to Output | 3750 | $V_{rms}$ |
| Operational Temperature | -40 to +85 | °C |
| Storage Temperature | -40 to +125 | °C |

[1] Derate linearly 8.33 mW / °C

Total Power Dissipation (PD):

$P_D = P_{HOOKSWITCH} + P_{BRIDGE} + P_{DARLINGTON} + P_{LED}$

$P_D = (R_{DS}(on))\,(I^2_L) + 2(V_F)(I_L) + (V_{CE})(I_L) + (V_{LED})(I_F)$

WHERE:

$R_{DS}(on)$ = Maximum relay on-resistance
$I_L$ = Maximum loop current
$V_F$ = Maximum diode forward voltage
$V_{CE}$ = Maximum voltage collector to emitter
$V_{LED}$ = Maximum LED forward voltage
$I_F$ = Maximum LED current

*Absolute Maximum Ratings are stress ratings. Stresses in excess of these ratings can cause permanent damage to the device. Functional operation of the device at conditions beyond those indicated in the operational sections of this data sheet is not implied.*

*Typical values are characteristic of the device at +25°C, and are the result of engineering evaluations. They are provided for information purposes only, and are not part of the manufacturing testing requirements.*

## Electrical Characteristics @25°C: Relay Section

| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Output Characteristics** | | | | | | |
| Blocking Voltage (Peak) | - | $V_L$ | - | - | 350 | $V_P$ |
| Load Current, Continuous | - | $I_L$ | - | - | 120 | $mA_{rms}$ / $mA_{DC}$ |
| On-Resistance | $I_L$=120mA | $R_{ON}$ | - | - | 20 | Ω |
| Off-State Leakage Current | $V_L$=350$V_P$, $T_J$=25°C | $I_{LEAK}$ | - | - | 1 | µA |
| Switching Speeds | | | | | | |
| Turn-On | $I_F$=5mA, $V_L$=10V | $t_{on}$ | - | - | 5 | ms |
| Turn-Off | | $t_{off}$ | - | - | 3 | ms |
| Output Capacitance | $V_L$=50V, f=1MHz | $C_{OUT}$ | - | 25 | - | pF |
| Current Limit | $I_F$=5mA | $I_{CL}$ | 190 | 235 | 280 | mA |
| **Input Characteristics** | | | | | | |
| Input Control Current to Activate | $I_L$=120mA | $I_F$ | - | - | 5 | mA |
| Input Voltage Drop | $I_F$=5mA | $V_F$ | 0.9 | 1.2 | 1.4 | V |
| Reverse Input Voltage | - | $V_R$ | - | - | 5 | V |
| Reverse Input Current | $V_R$=5V | $I_R$ | - | - | 10 | µA |

## Electrical Characteristics @25ºC: Detector Section

| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Output Characteristics** | | | | | | |
| Phototransistor Blocking Voltage | $I_C$=10µA | $BV_{CEO}$ | 20 | 50 | - | V |
| Phototransistor Dark Current | $V_{CE}$=5V, $I_F$=0mA | $I_{CEO}$ | - | 50 | 500 | nA |
| Saturation Voltage | $I_C$=2mA, $I_F$=16mA | $V_{SAT}$ | - | 0.3 | 0.5 | V |
| Current Transfer Ratio | $I_F$=6mA, $V_{CE}$=0.5V | CTR | 33 | 400 | - | % |
| **Input Characteristics** | | | | | | |
| Input Control Current | $I_C$=2mA, $V_{CE}$=0.5V | $I_F$ | - | 2 | 6 | mA |
| Input Voltage Drop | $I_F$=5mA | $V_F$ | 0.9 | 1.2 | 1.4 | V |
| Input Current (Detector Must be Off) | $I_C$=1µA, $V_{CE}$=5V | $I_F$ | 5 | 25 | - | µA |

## Electrical Characteristics @25ºC (Unless Otherwise Noted): Bridge Rectifier Section

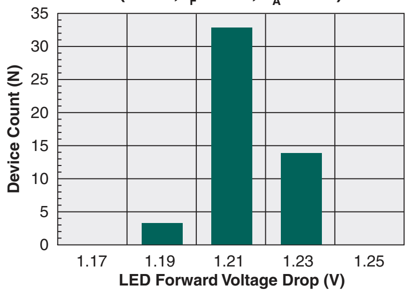
| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Voltage | - | $V_{RD}$ | - | - | 100 | V |
| Forward Voltage Drop | $I_{FD}$=120mA | $V_{FD}$ | - | - | 1.5 | V |
| Reverse Leakage Current | $T_J$=25ºC, $V_R$=100V | $I_{RD}$ | - | - | 10 | µA |
| | $T_J$=85ºC | | - | 50 | - | |
| Forward Current | | | | | | |
| Continuous | - | $I_{FD}$ | - | - | 140 | mA |
| Peak | t=10ms | | - | - | 500 | |

## Electrical Characteristics @25ºC: Darlington Transistor Section

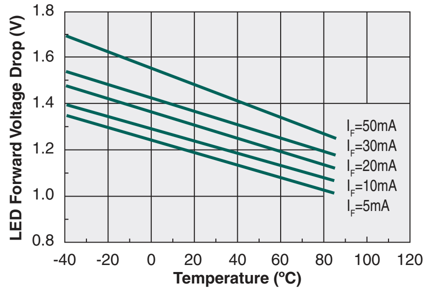
| Parameter | Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Collector-Emitter Voltage | $I_C$=10mA$_{DC}$, $I_B$=0mA | $V_{CEO}$ | 40 | - | - | V |
| Collector Current, Continuous | $V_C$=3.5V | $I_C$ | - | - | 120 | mA |
| Power Dissipation | - | $P_D$ | - | - | 500 | mW |
| Off-State Collector-Emitter Leakage Current | $V_{CE}$=10V, $I_B$=0mA | $I_{CEX}$ | - | - | 1 | µA |
| DC Current Gain | $V_{CE}$=10V$_{DC}$, $I_C$=120mA | $h_{FE}$ | 10,000 | - | - | - |
| Saturation Voltage | $I_C$=120mA | $V_{CE(sat)}$ | - | - | 1.5 | V |
| Total Harmonic Distortion | $I_C$=40mA, $f_O$=300Hz @ -10dBm | - | - | - | -80 | dB |

## DEVICE PERFORMANCE DATA*

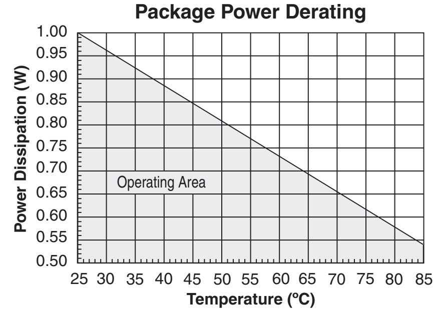
**Typical LED Forward Voltage Drop (N=50, $I_F$=5mA, $T_A$=25ºC)**




**Typical LED Forward Voltage Drop vs. Temperature**

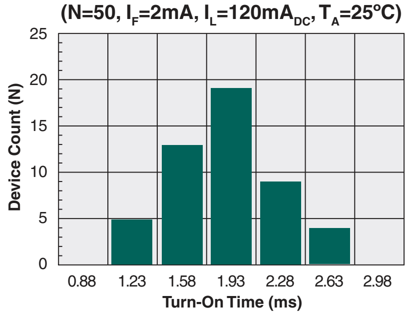



**Package Power Derating**

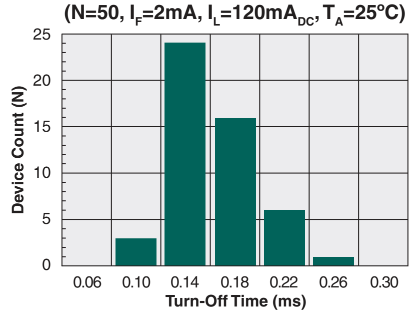



## RELAY PERFORMANCE DATA*

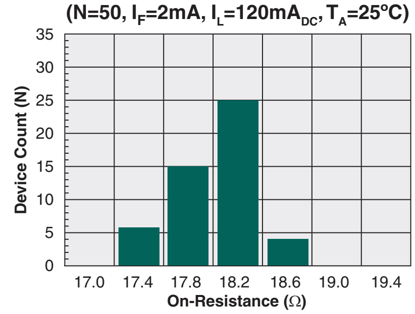
**Typical Turn-On Time (N=50, $I_F$=2mA, $I_L$=120mA$_{DC}$, $T_A$=25ºC)**



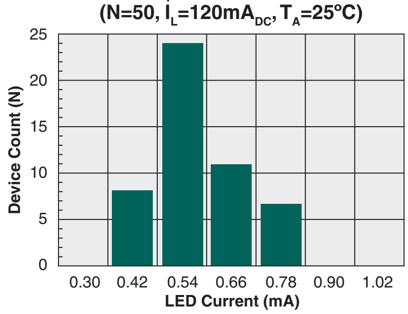

**Typical Turn-Off Time (N=50, $I_F$=2mA, $I_L$=120mA$_{DC}$, $T_A$=25ºC)**



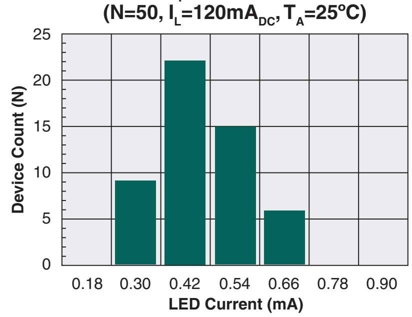

**Typical On-Resistance Distribution (N=50, $I_F$=2mA, $I_L$=120mA$_{DC}$, $T_A$=25ºC)**



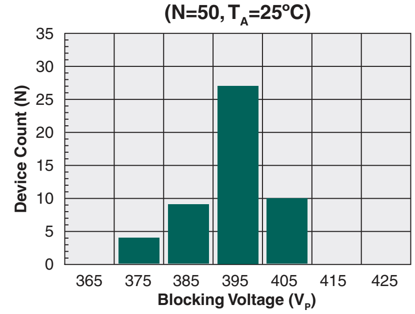

**Typical $I_F$ for Switch Operation (N=50, $I_L$=120mA$_{DC}$, $T_A$=25ºC)**




**Typical $I_F$ for Switch Dropout (N=50, $I_L$=120mA$_{DC}$, $T_A$=25ºC)**



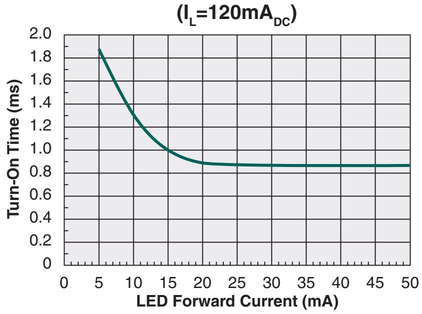

**Typical Blocking Voltage Distribution (N=50, $T_A$=25ºC)**



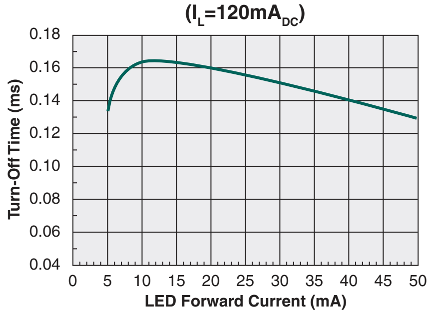

* Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.

## RELAY PERFORMANCE DATA (cont)*

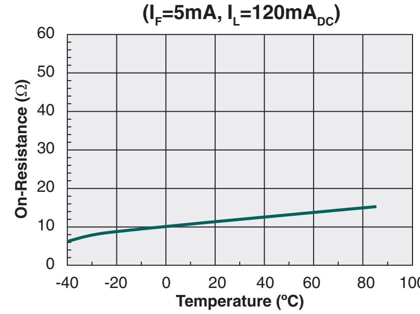
### Typical Turn-On Time vs. LED Forward Current ($I_L$=120mA$_{DC}$)



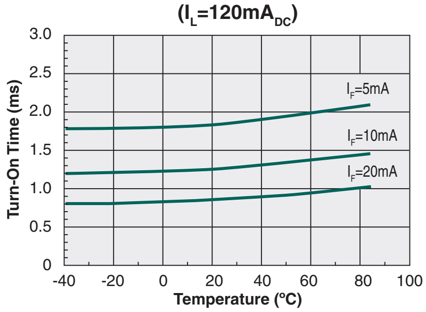

### Typical Turn-Off Time vs. LED Forward Current ($I_L$=120mA$_{DC}$)



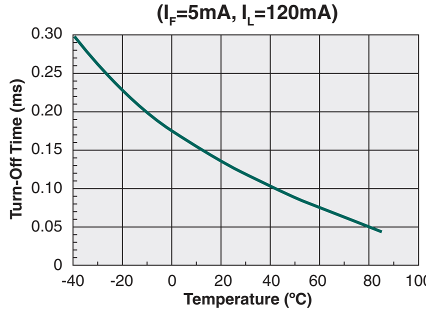

### Typical On-Resistance vs. Temperature ($I_F$=5mA, $I_L$=120mA$_{DC}$)



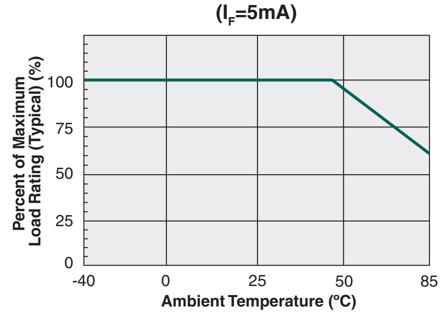

### Typical Turn-On Time vs. Temperature ($I_L$=120mA$_{DC}$)



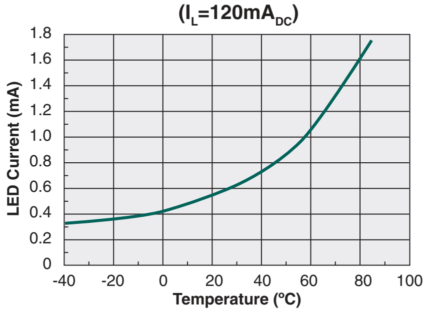

### Typical Turn-Off Time vs. Temperature ($I_F$=5mA, $I_L$=120mA)



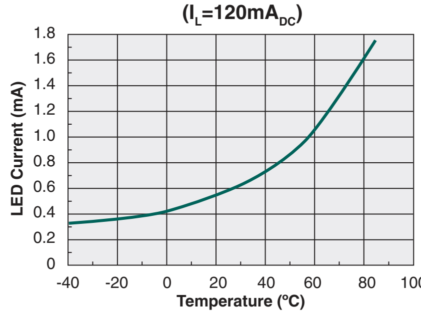

### Load Current vs. Ambient Temperature ($I_F$=5mA)



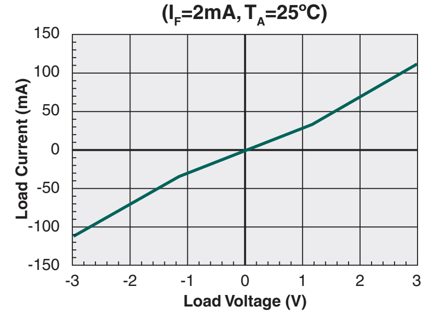

### Typical $I_F$ for Switch Operation vs. Temperature ($I_L$=120mA$_{DC}$)



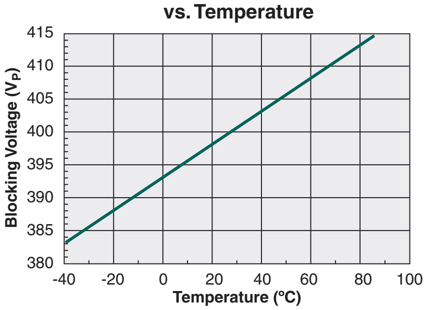

### Typical $I_F$ for Switch Dropout vs. Temperature ($I_L$=120mA$_{DC}$)



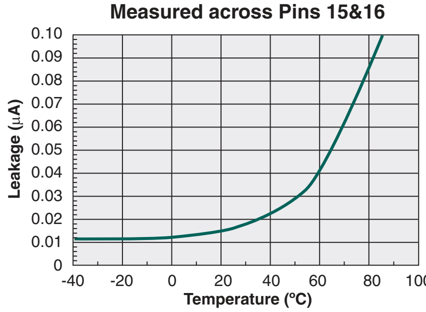

### Typical Load Current vs. Load Voltage ($I_F$=2mA, $T_A$=25ºC)



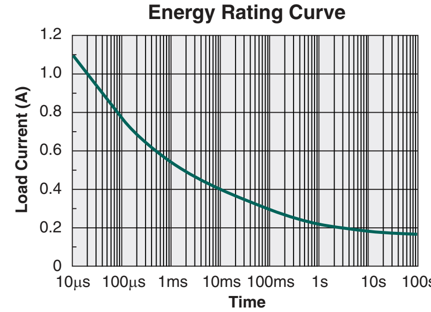

### Typical Blocking Voltage vs. Temperature




### Typical Leakage vs. Temperature Measured across Pins 15&16



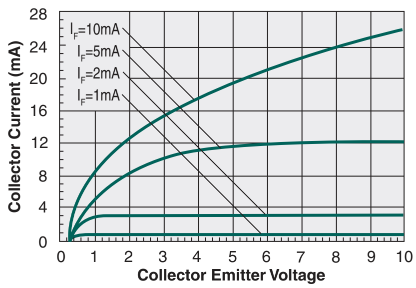

### Energy Rating Curve



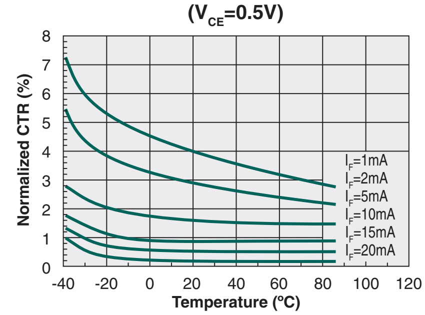

* Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.

## PHOTOTRANSISTOR PERFORMANCE DATA*

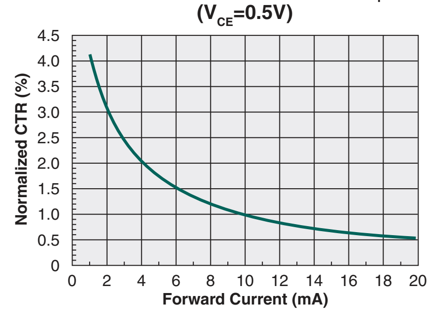
Typical Transfer Characteristics of Single Transistor Detector



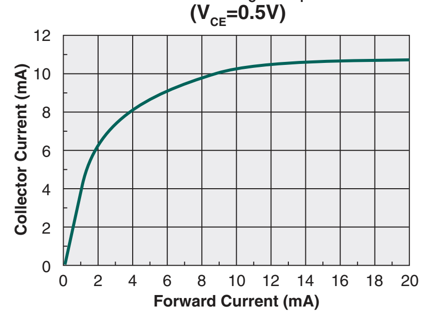

Single Transistor Typical Normalized CTR vs. Temperature ($V_{CE}$=0.5V)




Single Transistor Typical Normalized CTR vs. $I_F$ ($V_{CE}$=0.5V)

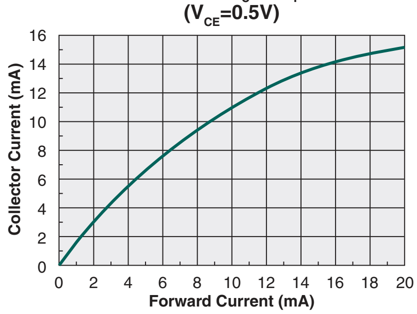



Single Transistor Typical $I_C$ vs. $I_F$ ($V_{CE}$=0.5V)

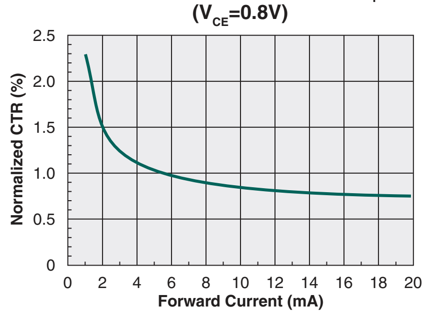



## DARLINGTON PERFORMANCE DATA*

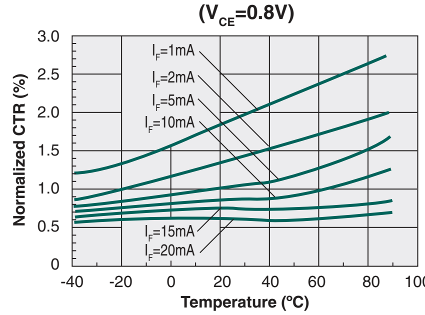
Darlington Transistor Typical $I_C$ vs. $I_F$ ($V_{CE}$=0.5V)



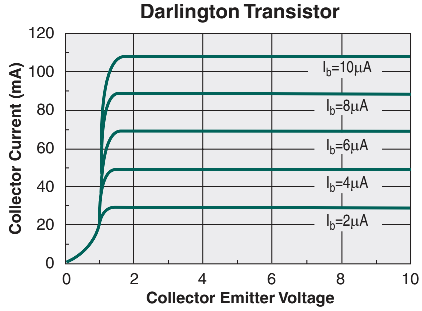

Darlington Transistor Typical Normalized CTR vs. $I_F$ ($V_{CE}$=0.8V)



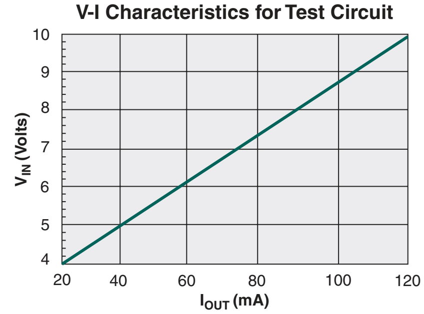

Darlington Transistor Typical Normalized CTR vs. Temperature ($V_{CE}$=0.8V)




Typical Transfer Characteristics of Darlington Transistor




V-I Characteristics for Test Circuit




* Unless otherwise noted, data presented in these graphs is typical of device operation at 25ºC.

## Manufacturing Information

### Moisture Sensitivity

All plastic encapsulated semiconductor packages are susceptible to moisture ingression. IXYS Integrated Circuits classifies its plastic encapsulated devices for moisture sensitivity according to the latest version of the joint industry standard, **IPC/JEDEC J-STD-020**, in force at the time of product evaluation. We test all of our products to the maximum conditions set forth in the standard, and guarantee proper operation of our devices when handled according to the limitations and information in that standard as well as to any limitations set forth in the information or standards referenced below.

Failure to adhere to the warnings or limitations as established by the listed specifications could result in reduced product performance, reduction of operable life, and/or reduction of overall reliability.

This product carries a **Moisture Sensitivity Level (MSL)** classification as shown below, and should be handled according to the requirements of the latest version of the joint industry standard **IPC/JEDEC J-STD-033**.

| Device | Moisture Sensitivity Level (MSL) Classification |
|---|---|
| ITC117PL | MSL 3 |

### ESD Sensitivity

This product is ESD Sensitive, and should be handled according to the industry standard **JESD-625**.

### Soldering Profile

Provided in the table below is the **IPC/JEDEC J-STD-020** Classification Temperature ($T_C$) and the maximum dwell time the body temperature of these surface mount devices may be ($T_C$ - 5)°C or greater. The Classification Temperature sets the Maximum Body Temperature allowed for these devices during reflow soldering processes.

| Device | Classification Temperature ($T_c$) | Dwell Time ($t_p$) | Max Reflow Cycles |
|---|---|---|---|
| ITC117PL | 245°C | 30 seconds | 3 |

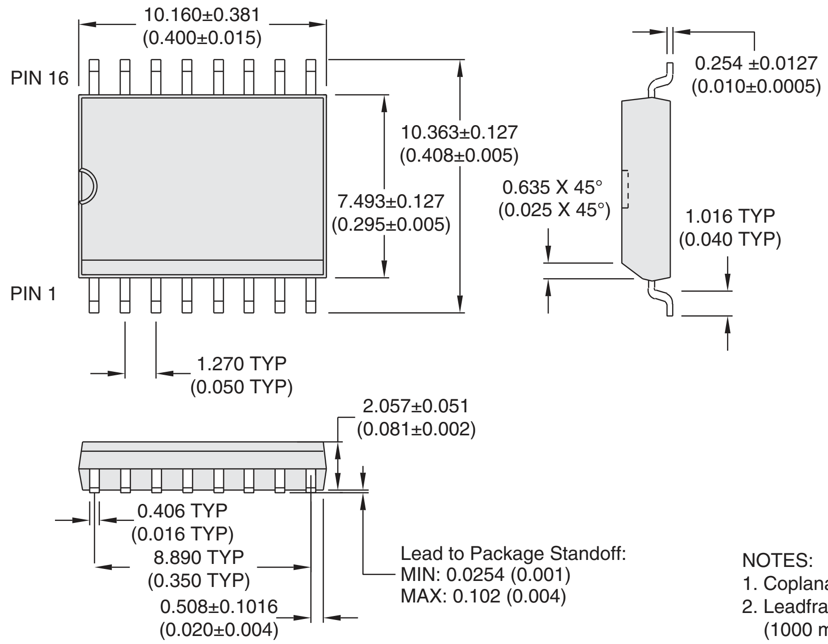
### Board Wash

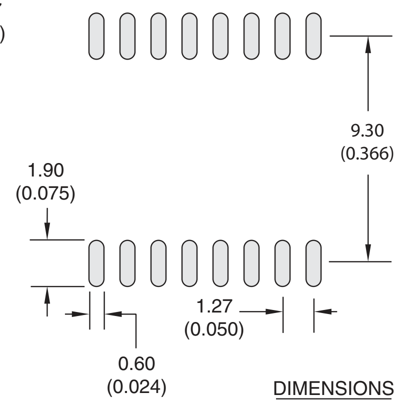
IXYS Integrated Circuits recommends the use of no-clean flux formulations. Board washing to reduce or remove flux residue following the solder reflow process is acceptable provided proper precautions are taken to prevent damage to the device. These precautions include but are not limited to: using a low pressure wash and providing a follow up bake cycle sufficient to remove any moisture trapped within the device due to the washing process. Due to the variability of the wash parameters used to clean the board, determination of the bake temperature and duration necessary to remove the moisture trapped within the package is the responsibility of the user (assembler). Cleaning or drying methods that employ ultrasonic energy may damage the device and should not be used. Additionally, the device must not be exposed to halide flux or solvents.

Pb RoHS e3

## MECHANICAL DIMENSIONS

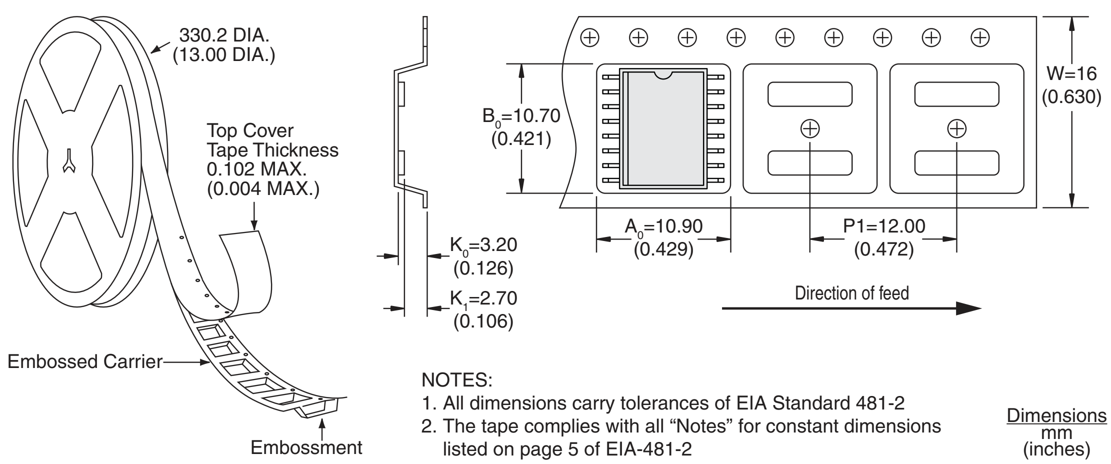
### ITC117PL




NOTES:
1. Coplanarity = 0.1016 (0.004) max.
2. Leadframe thickness does not include solder plating (1000 microinch maximum).

### ITC117PLTR Tape & Reel




NOTES:
1. All dimensions carry tolerances of EIA Standard 481-2
2. The tape complies with all "Notes" for constant dimensions listed on page 5 of EIA-481-2

Dimensions
mm
(inches)

**For additional information please visit our website at: https://www.ixysic.com**

IXYS A Littelfuse Technology



Specification: DS-ITC117PL_R05

11/17/2020