FAIRCHILD
SEMICONDUCTOR®

January 2009

MCT2M, MCT2EM, MCT210M, MCT271M Phototransistor Optocouplers

Features

- UL recognized (File # E90700, Vol. 2)
- IEC60747-5-2 recognized (File # 102497)
  – Add option V (e.g., MCT2VM)

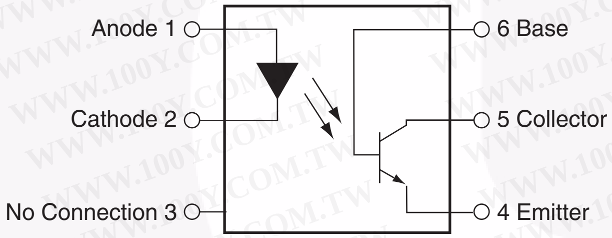
Applications

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

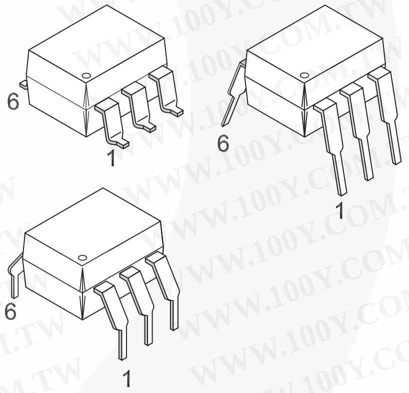
Description

The MCT2XXM series optoisolators consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

Schematic



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	Parameter	Value	Units
TOTAL DEVICE			
T_{STG}	Storage Temperature	-40 to +150	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_{SOL}	Lead Solder Temperature	260 for 10 sec	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	250	mW
	Derate above 25°C	2.94	mW/°C
EMITTER			
I_F	DC/Average Forward Input Current	60	mA
V_R	Reverse Input Voltage	3	V
I_F(pk)	Forward Current – Peak (300µs, 2% Duty Cycle)	3	A
P_D	LED Power Dissipation @ T_A = 25°C	120	mW
	Derate above 25°C	1.41	mW/°C
DETECTOR			
I_C	Collector Current	50	mA
V_{CEO}	Collector-Emitter Voltage	30	V
P_D	Detector Power Dissipation @ T_A = 25°C	150	mW
	Derate above 25°C	1.76	mW/°C

Electrical Characteristics (T_A = 25°C unless otherwise specified)

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Units
EMITTER							
V_F	Input Forward Voltage	I_F = 20mA	MCT2M MCT2EM MCT271M		1.25	1.50	V
		T_A = 0°C–70°C, I_F = 40mA	MCT210M		1.33		
I_R	Reverse Leakage Current	V_R = 3.0V	MCT2M MCT2EM MCT271M		0.001	10	µA
		T_A = 0°C–70°C, V_R = 6.0V	MCT210M				
DETECTOR							
BV_{CEO}	Collector-Emitter Breakdown Voltage	I_C = 1.0mA, I_F = 0	ALL	30	100		V
		T_A = 0°C–70°C	MCT210M				
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10µA, I_F = 0	MCT2M MCT2EM MCT271M	70	120		V
		T_A = 0°C–70°C	MCT210M	30			
BV_{ECO}	Emitter-Collector Breakdown Voltage	I_E = 100µA, I_F = 0	MCT2M MCT2EM MCT271M	7	10		V
		T_A = 0°C–70°C	MCT210M	6	10		
I_{CEO}	Collector-Emitter Dark Current	V_{CE} = 10V, I_F = 0	ALL		1	50	nA
		V_{CE} = 5V, T_A = 0°C–70°C				30	µA
I_{CBO}	Collector-Base Dark Current	V_{CB} = 10V, I_F = 0	ALL			20	nA
C_{CE}	Capacitance	V_{CE} = 0V, f = 1MHz	ALL		8		pF

*All typical T_A = 25°C

Isolation Characteristics

Symbol	Parameter	Test Conditions	Min	Typ*	Max	Units
V_{ISO}	Input-Output Isolation Voltage	f = 60Hz, t = 1 sec.	7500			Vac(pk)
R_{ISO}	Isolation Resistance	V_{I-O} = 500 VDC	10^{11}			Ω
C_{ISO}	Isolation Capacitance			0.2	2	pF

*All typicals at T_A = 25°C

Electrical Characteristics (Continued) (T_A = 25°C unless otherwise specified)

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.*	Max.	Unit
DC CHARACTERISTICS							
CTR	Output Collector Current	T_A = 0°C–70°C	MCT210M	150			%
		I_F = 10mA, V_{CE} = 10V	MCT2M MCT2EM	20			
			MCT271M	45		90	
		I_F = 3.2mA to 32mA, V_{CE} = 0.4V, T_A = 0°C–70°C	MCT210M	50			
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_C = 2mA, I_F = 16mA	MCT2M MCT2EM MCT271M			0.4	V
		I_C = 16mA, I_F = 32mA, T_A = 0°C–70°C	MCT210M				
AC CHARACTERISTICS							
t_{on}	AC Characteristic Saturated Turn-on Time from 5V to 0.8V	I_F = 15mA, V_{CC} = 5V, R_L = 2kΩ, R_B = Open (Fig. 11)	MCT2M MCT2EM		1.1		µs
		I_F = 20mA, V_{CC} = 5 V, R_L = 2kΩ, R_B = 100kΩ) (Fig. 11)	MCT2M MCT2EM		1.3		
t_{off}	Saturated Turn-off Time from SAT to 2.0 V	I_F = 15mA, V_{CC} = 5V, R_L = 2kΩ, R_B = Open (Fig. 11)	MCT2M MCT2EM		50		µs
		I_F = 20mA, V_{CC} = 5V, R_L = 2kΩ, R_B = 100kΩ (Fig. 11)	MCT2M MCT2EM		20		
t_{on}	Turn-on Time	I_F = 10mA, V_{CC} = 10V, R_L = 100Ω	MCT2M MCT2EM		2		µs
t_{off}	Turn-off Time	I_F = 10mA, V_{CC} = 10V, R_L = 100Ω	MCT2M MCT2EM		2		µs
t_r	Rise Time	I_F = 10mA, V_{CC} = 10V, R_L = 100Ω	MCT2M MCT2EM		2		µs
t_f	Fall Time	I_F = 10mA, V_{CC} = 10V, R_L = 100Ω	MCT2M MCT2EM		1.5		µs
t_{on}	Saturated turn-on time	I_F = 16mA, R_L = 1.9kΩ, V_{CC} = 5V (Fig. 11)	MCT271M		1.0		µs
t_{off}	Saturated turn-off time (Approximates a typical TTL interface)				48		µs
t_{on}	Saturated turn-on time	I_F = 16mA, R_L = 4.7kΩ, V_{CC} = 5 V (Fig. 20)	MCT271M		1.0		µs
t_{off}	Saturated turn-off time (Approximates a typical low power TTL interface)				98		µs
t_r	Saturated rise time	I_F = 16mA, R_L = 560Ω, V_{CC} = 5V) (Fig. 11, 12)	MCT210M		1.0		µs
t_f	Saturated fall time				11		µs
$T_{PD\ (HL)}$	Saturated propagation delay – HIGH to LOW	I_F = 16mA, R_L = 2.7kΩ (Fig. 11, 12)	MCT210M		1.0		µs
$T_{PD\ (LH)}$	Saturated propagation delay – LOW to HIGH				50		µs
t_r	Non-saturated rise time	I_C = 2mA, V_{CC} = 5V, R_L = 100Ω (Fig. 11)	MCT210M		2		µs
t_f	Non-saturated fall time				2		µs
t_{on}	Non-saturated turn-on time	I_C = 2mA, V_{CC} = 5V, R_L = 100Ω (Fig. 20)	MCT271M		2	7	µs
t_{off}	Non-saturated turn-off time				2	7	µs

*All typicals at T_A = 25°C

Typical Performance Curves

Fig. 1 LED Forward Voltage vs. Forward Current

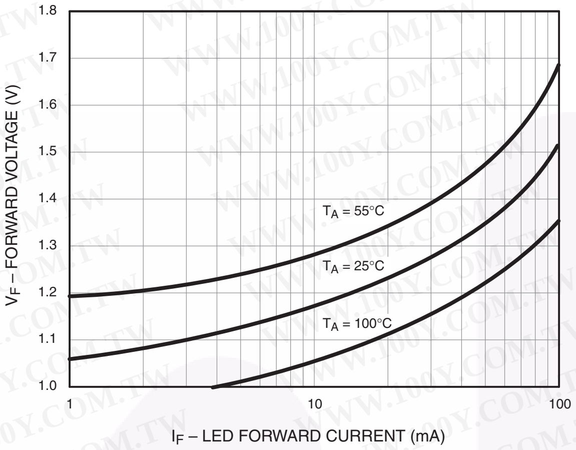


Fig. 2 Normalized CTR vs. Forward Current

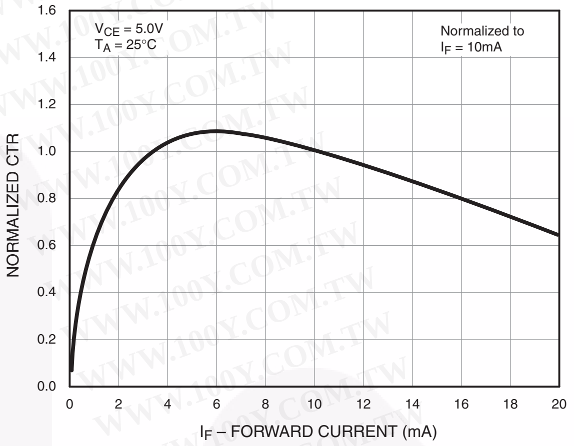


Fig. 3 Normalized CTR vs. Ambient Temperature

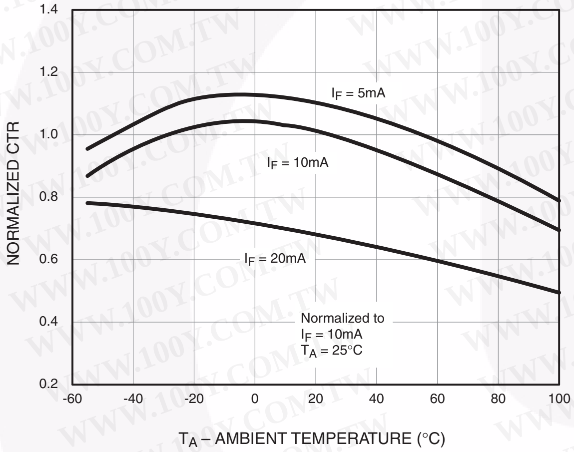


Fig. 4 CTR vs. RBE (Unsaturated)

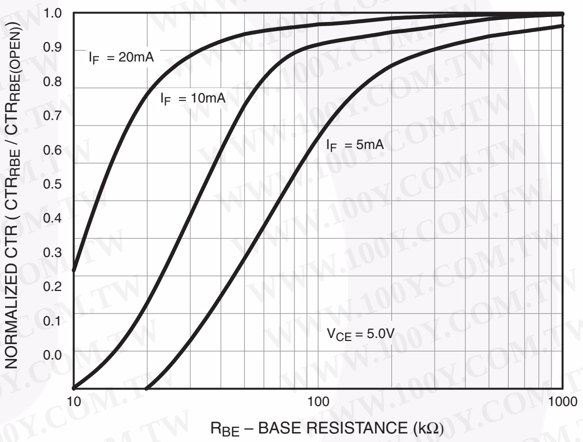


Fig. 5 CTR vs. RBE (Saturated)

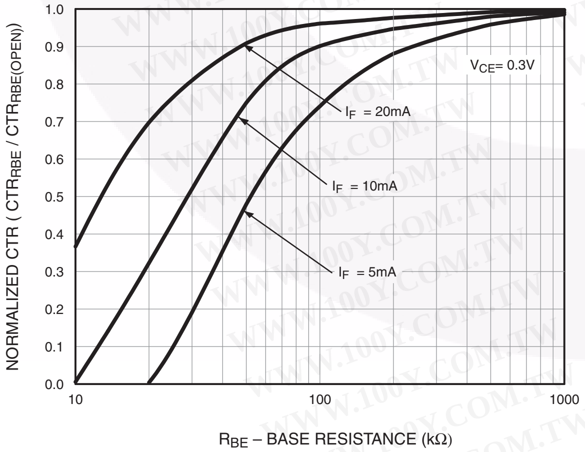
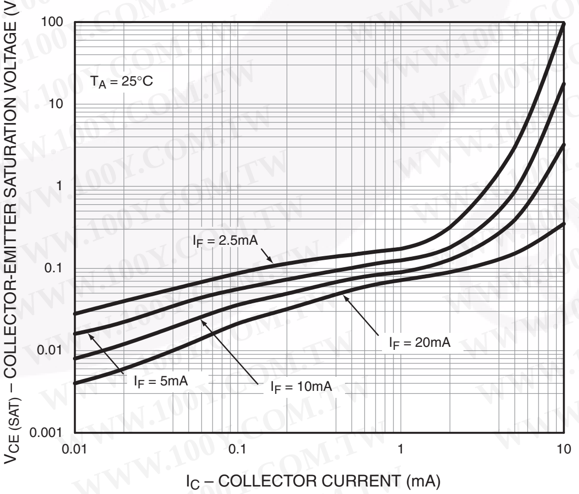


Fig. 6 Collector-Emitter Saturation Voltage vs Collector Current



Typical Performance Curves (Continued)

Fig. 7 Switching Speed vs. Load Resistor

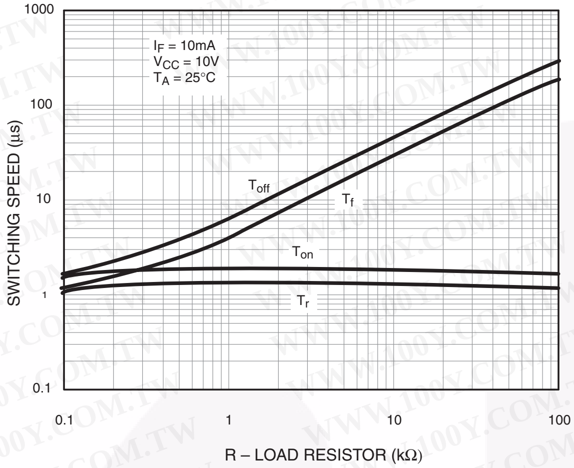


Fig. 8 Normalized t_{on} vs. R_{BE}

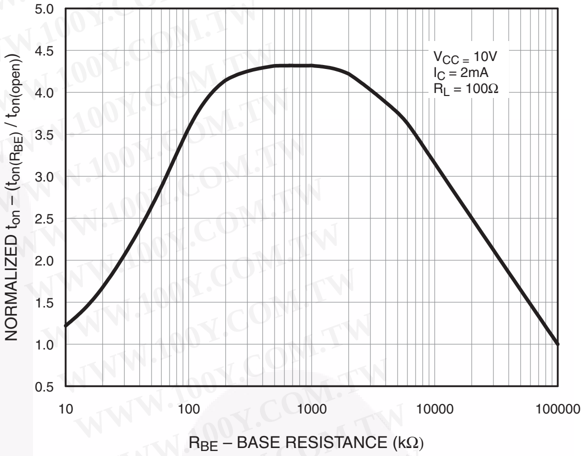


Fig. 9 Normalized t_{off} vs. R_{BE}

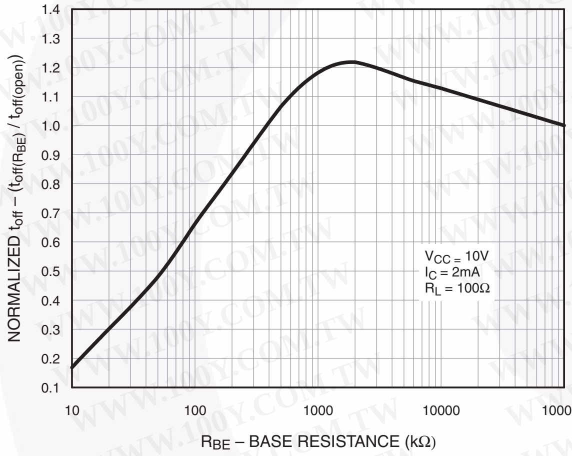
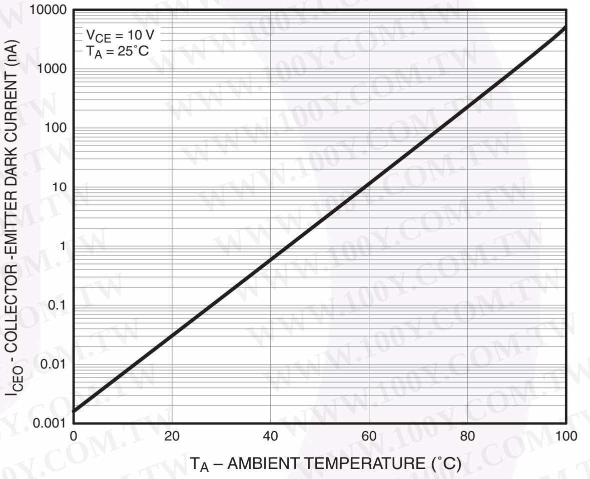


Fig. 10 Dark Current vs. Ambient Temperature



Typical Electro-Optical Characteristics

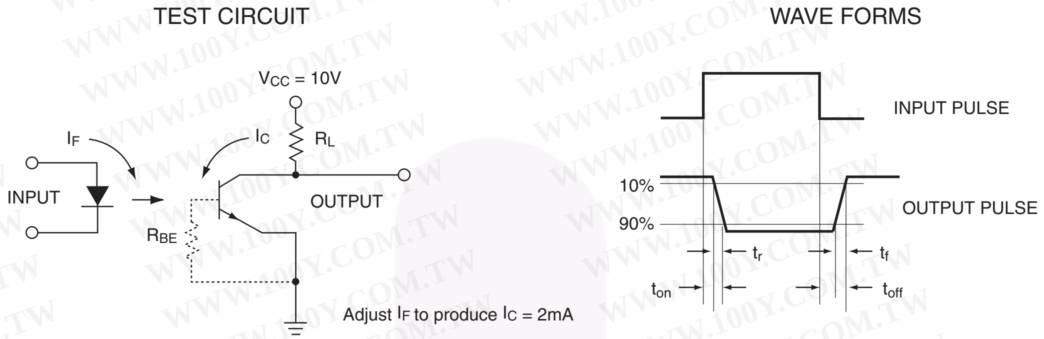


Figure 11. Switching Time Test Circuit and Waveforms

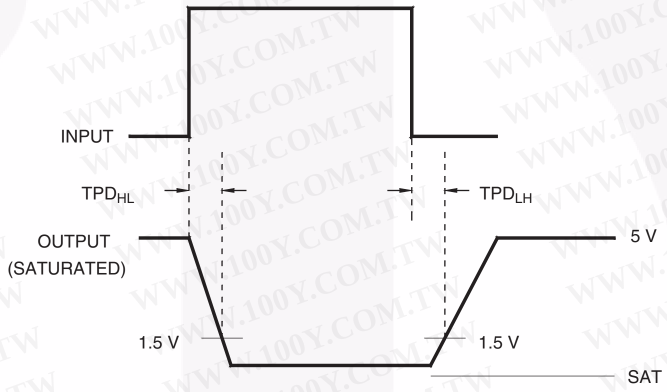
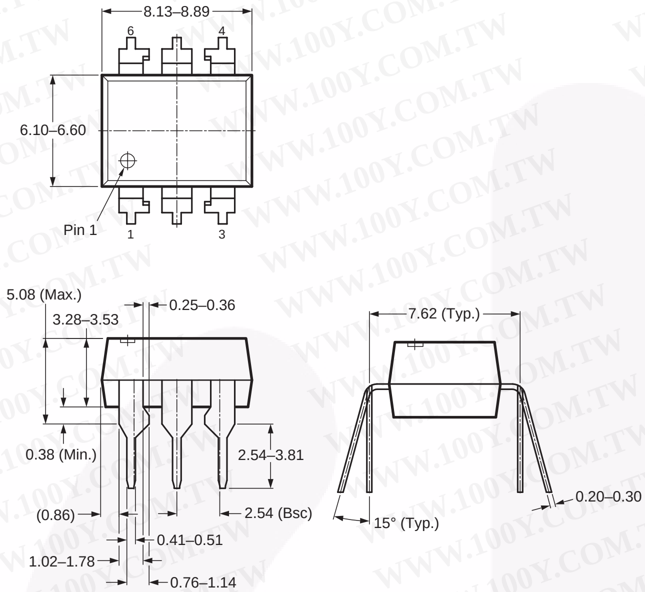


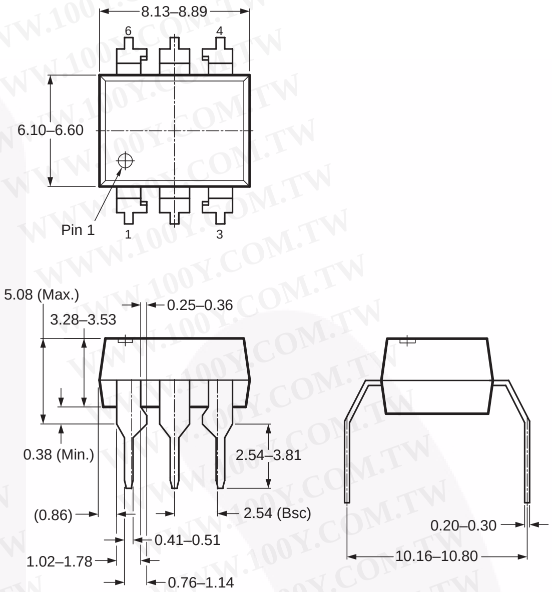
Figure 12. Switching Time Waveforms (MCT210M)

Package Dimensions

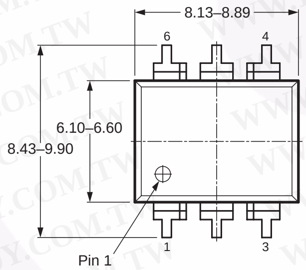
Through Hole

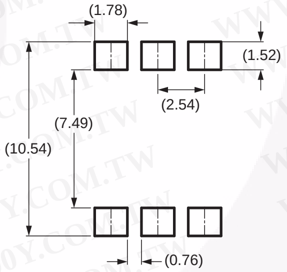


0.4" Lead Spacing

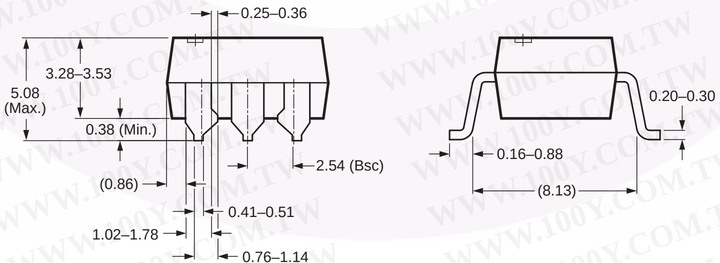


Surface Mount





Rcommended Pad Layout

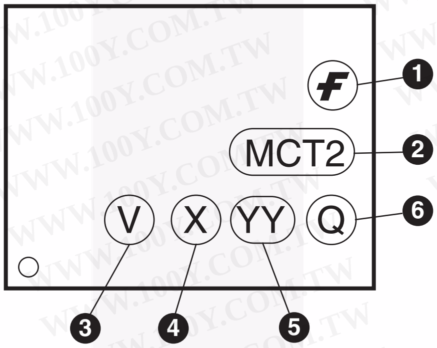


Note:
All dimensions in mm.

Ordering Information

Option	Order Entry Identifier (Example)	Description
No suffix	MCT2M	Standard Through Hole Device (50 units per tube)
S	MCT2SM	Surface Mount Lead Bend
SR2	MCT2SR2M	Surface Mount; Tape and Reel (1,000 units per reel)
T	MCT2TM	0.4" Lead Spacing
V	MCT2VM	IEC60747-5-2
TV	MCT2TVM	IEC60747-5-2, 0.4" Lead Spacing
SV	MCT2SVM	IEC60747-5-2, Surface Mount
SR2V	MCT2SR2VM	IEC60747-5-2, Surface Mount, Tape and Reel (1,000 units per reel)

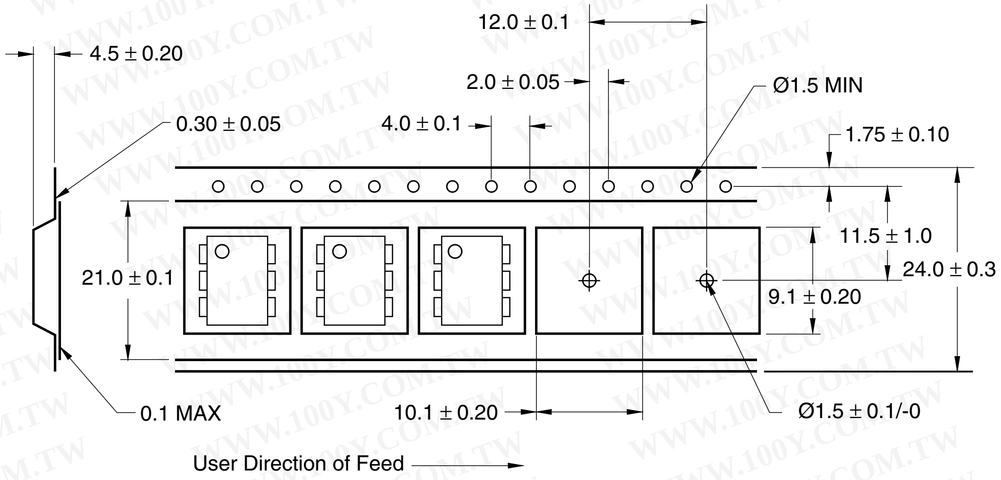
Marking Information



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., ‘7’
5	Two digit work week ranging from ‘01’ to ‘53’
6	Assembly package code

*Note – Parts that do not have the ‘V’ option (see definition 3 above) that are marked with date code ‘325’ or earlier are marked in portrait format.

Carrier Tape Specification



Reflow Profile