ON Semiconductor®

MCT2EM, TIL111M, TIL117M
6-Pin General Purpose Phototransistor Optocouplers

Features

- Minimum Current Transfer Ratio at I_F = 10 mA, V_{CE} = 10 V:
  - 20% for MCT2EM
  - 50% for TIL117M
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC_{RMS} for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

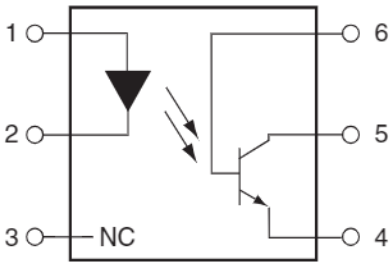
Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a standard plastic six-pin dual-in-line package.

Schematic



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

Figure 1. Schematic

Package Outlines

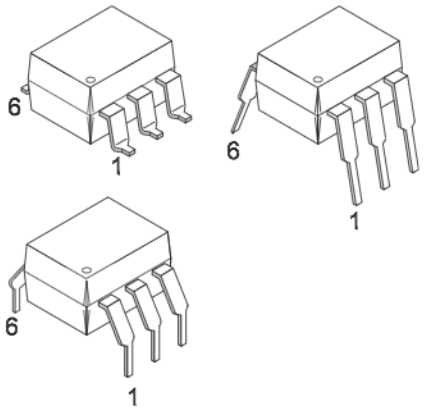


Figure 2. Package Outlines

November-2017, Rev. 2

Publication Order Number :
MCT2EM/D

Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V_{RMS}	I–IV
	< 300 V_{RMS}	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V_{PR}	Input-to-Output Test Voltage, Method A, V_{IORM} x 1.6 = V_{PR}, Type and Sample Test with t_m = 10 s, Partial Discharge < 5 pC	1360	V_{peak}
	Input-to-Output Test Voltage, Method B, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with t_m = 1 s, Partial Discharge < 5 pC	1594	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	850	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	6000	V_{peak}
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T_S	Case Temperature(1)	175	°C
$I_{S,INPUT}$	Input Current(1)	350	mA
$P_{S,OUTPUT}$	Output Power(1)	800	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V(1)	> 10^9	Ω

Note:

1. Safety limit values – maximum values allowed in the event of a failure.

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. T_A = 25°C unless otherwise specified.

Symbol	Parameter	Device	Value	Unit
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +125	°C
T_{OPR}	Operating Temperature	All	-40 to +100	°C
T_J	Junction Temperature	All	-40 to +125	ºC
T_{SOL}	Lead Solder Temperature	All	260 for 10 seconds	°C
P_D	Total Device Power Dissipation @ T_A = 25°C	All	250	mW
	Derate Above 25°C	All	2.94	mW/°C
EMITTER				
I_F	DC/Average Forward Input Current	All	60	mA
V_R	Reverse Input Voltage	TIL111M	3	V
		MCT2EM, TIL117M	6	V
I_F(pk)	Forward Current – Peak (300 µs, 2% Duty Cycle)	All	3	A
P_D	LED Power Dissipation @ T_A = 25°C	All	120	mW
	Derate Above 25°C	All	1.41	mW/°C
DETECTOR				
V_{CEO}	Collector-to-Emitter Voltage	All	30	V
V_{CBO}	Collector-to-Base Voltage	All	70	V
V_{ECO}	Emitter-to-Collector Voltage	All	7	V
V_{EBO}	Emitter-to-Base Voltage	All	7	V
P_D	Detector Power Dissipation @ T_A = 25°C	All	150	mW
	Derate Above 25°C	All	1.76	mW/°C

Electrical Characteristics

TA = 25°C unless otherwise specified.

Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
EMITTER						
V_F	Input Forward Voltage	I_F = 10 mA		1.18	1.50	V
I_R	Reverse Leakage Current	V_R = 6.0 V		0.001	10	μA
DETECTOR						
BV_{CEO}	Collector-to-Emitter Breakdown Voltage	I_C = 1.0 mA, I_F = 0	30	100		V
BV_{CBO}	Collector-to-Base Breakdown Voltage	I_C = 100 μA, I_F = 0	70	120		V
BV_{EBO}	Emitter-to-Base Breakdown Voltage	I_E = 10 uA, I_F = 0	7	10		V
BV_{ECO}	Emitter-to-Collector Breakdown Voltage	I_E = 100 μA, I_F = 0	7	10		V
I_{CEO}	Collector-to-Emitter Dark Current	V_{CE} = 10 V, I_F = 0		1	50	nA
I_{CBO}	Collector-to-Base Dark Current	V_{CB} = 10 V			20	nA
C_{CE}	Capacitance	V_{CE} = 0 V, f = 1 MHz		8		pF

Transfer Characteristics

Symbol	Parameter	Test Conditions	Device	Min.	Typ.	Max.	Unit
DC CHARACTERISTICS							
CTR	Current Transfer Ratio, Collector-to-Emitter	I_F = 10 mA, V_{CE} = 10 V	MCT2EM	20			%
			TIL117M	50			%
$V_{CE\ (SAT)}$	Collector-to-Emitter Saturation Voltage	I_C = 2 mA, I_F = 16 mA	MCT2EM, TIL111M			0.4	V
		I_C = 0.5 mA, I_F = 10 mA	TIL117M			0.4	V
AC CHARACTERISTICS							
T_{ON}	Non-Saturated Turn-on Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	MCT2EM		2		μs
		I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	TIL117M		2	10	μs
T_{OFF}	Turn-off Time	I_F = 10 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	MCT2EM		2		μs
		I_C = 2 mA, V_{CC} = 10 V, R_L = 100 Ω (Figure 13)	TIL117M		2	10	μs

Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	t = 1 Minute	4170			VAC_{RMS}
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, f = 1 MHz		0.2		pF
R_{ISO}	Isolation Resistance	V_{I-O} = ±500 VDC, T_A = 25°C	10^{11}			Ω

Typical Performance Curves

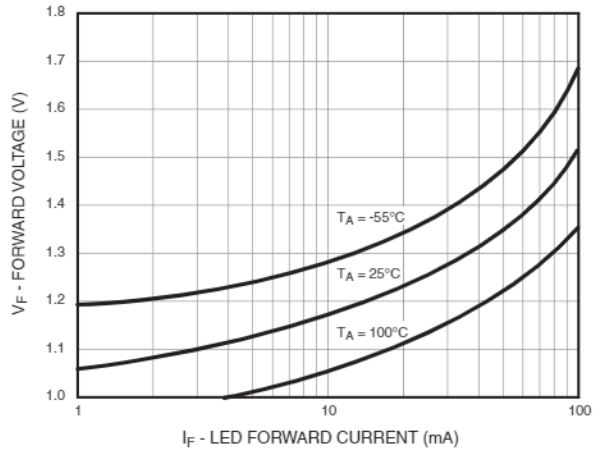


Figure 3. LED Forward Voltage vs. Forward Current

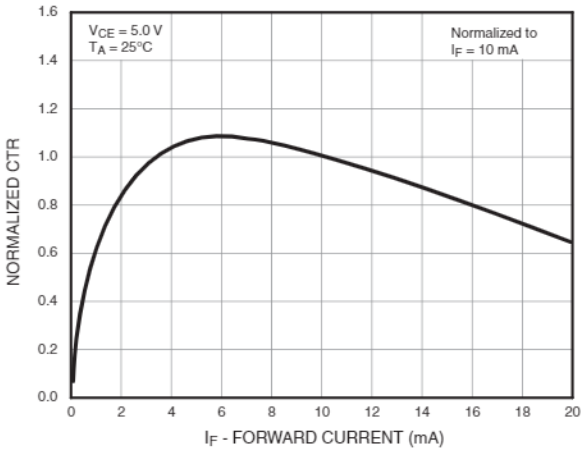


Figure 4. Normalized CTR vs. Forward Current

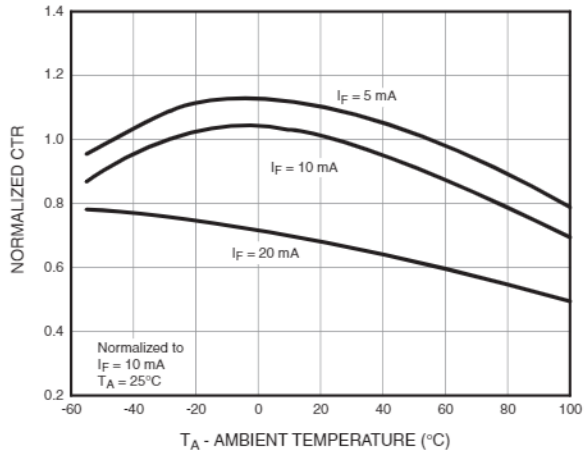


Figure 5. Normalized CTR vs. Ambient Temperature

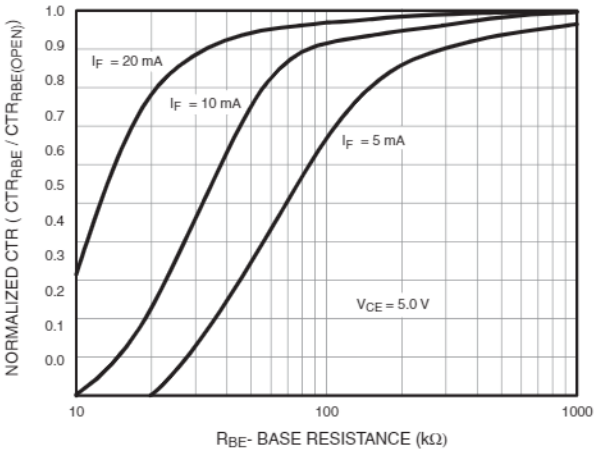


Figure 6. CTR vs. RBE (Unsaturated)

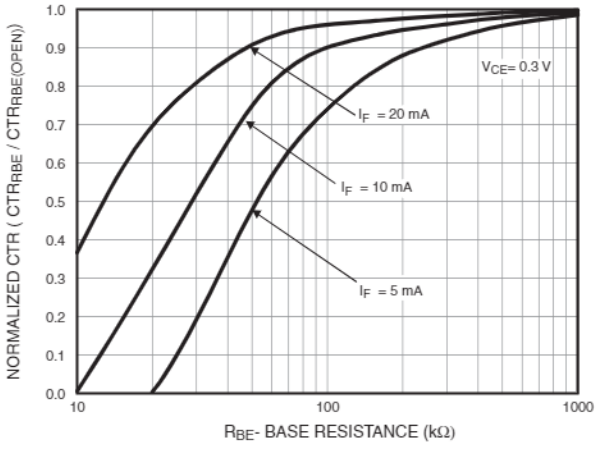


Figure 7. CTR vs. RBE (Saturated)

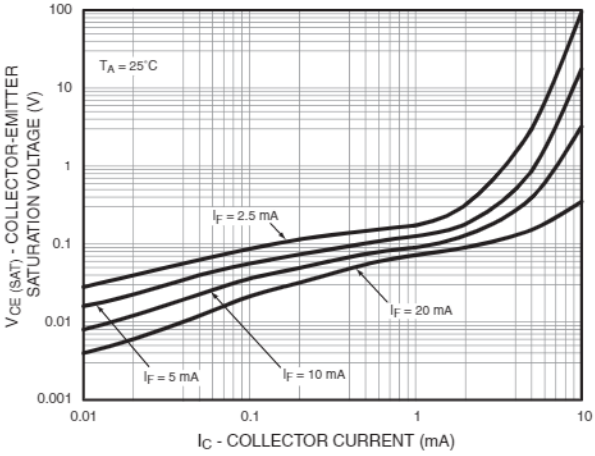


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)

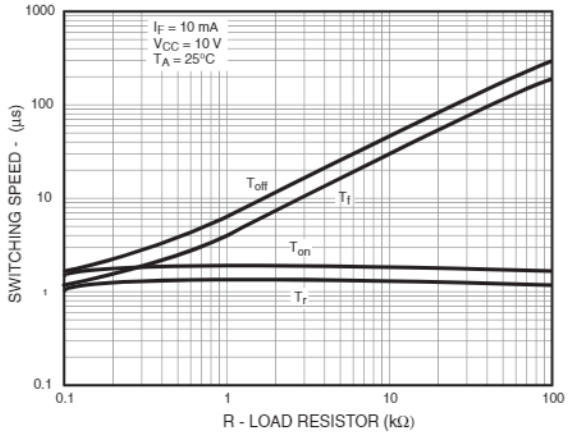


Figure 9. Switching Speed vs. Load Resistor

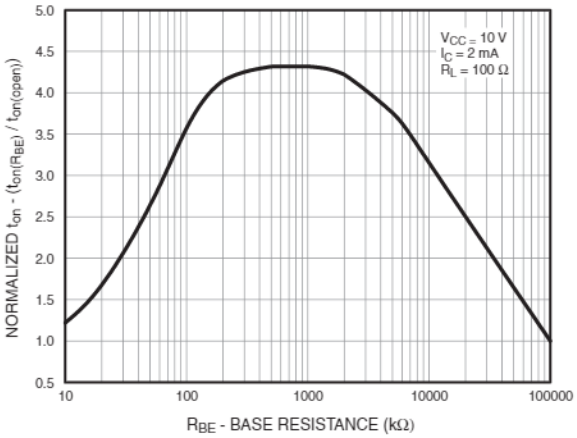


Figure 10. Normalized t_{on} vs. R_{BE}

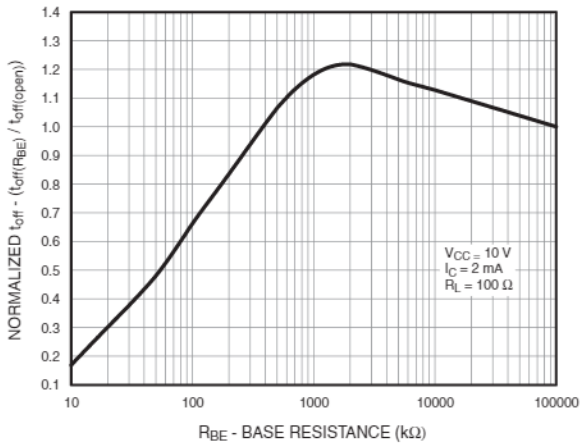


Figure 11. Normalized t_{off} vs. R_{BE}

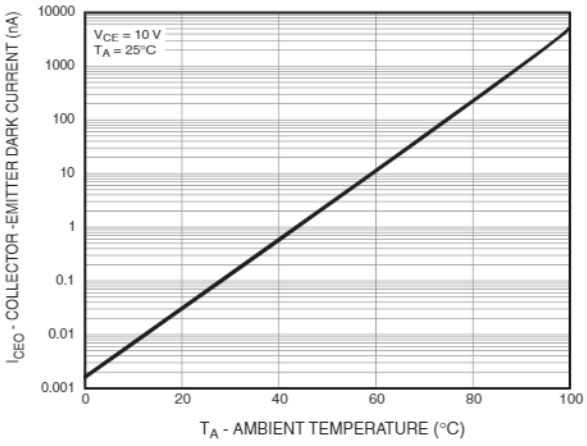


Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveforms

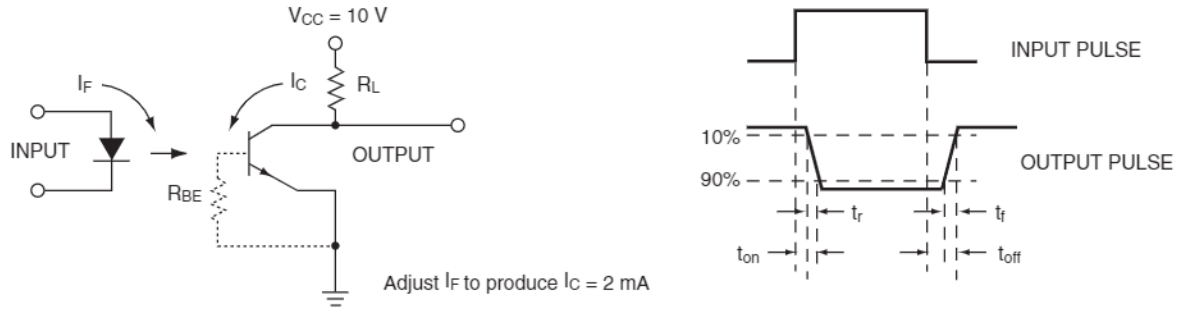


Figure 13. Switching Time Test Circuit and Waveforms

Reflow Profile

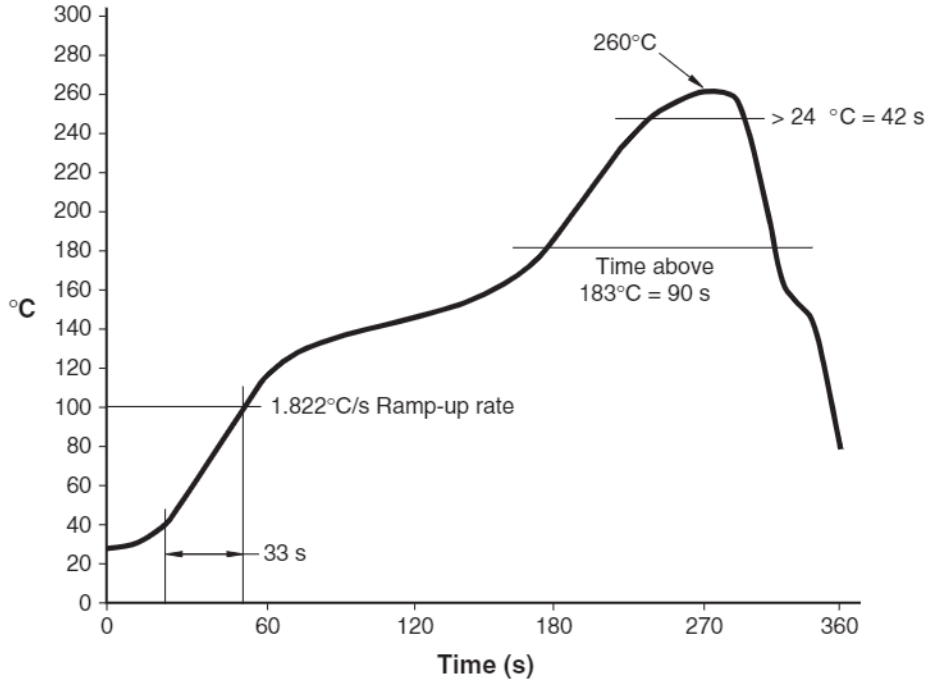


Figure 14. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
MCT2EM	DIP 6-Pin	Tube (50 Units)
MCT2ESM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
MCT2ESR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
MCT2EVM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MCT2ESVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
MCT2ESR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
MCT2ETVM	DIP 6-Pin, 0.4” Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

Note:

2. The product orderable part number system listed in this table also applies to the TIL111M and TIL117M devices.

Marking Information

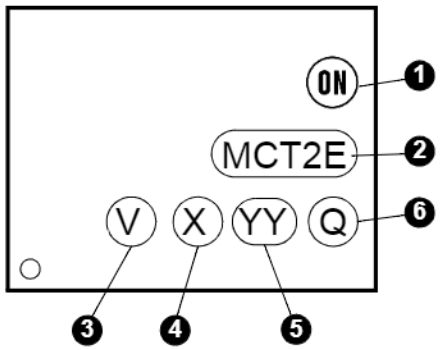


Figure 15. Top Mark

Table 1. Top Mark Definitions

1	ON Semiconductor Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., “6”
5	Digit Work Week, Ranging from “01” to “53”
6	Assembly Package Code

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative